THE INDEPENDENT GUIDE TO IBM-STANDARD PERSONAL COMPUTING

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PC MAGAZINE

VOLUME 8 NUMBER 7
APRIL 11, 1989

After Hours:
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Plus 3 New Tools for Personal Finance

PC Labs Tests 15 Fax Boards That Really Work

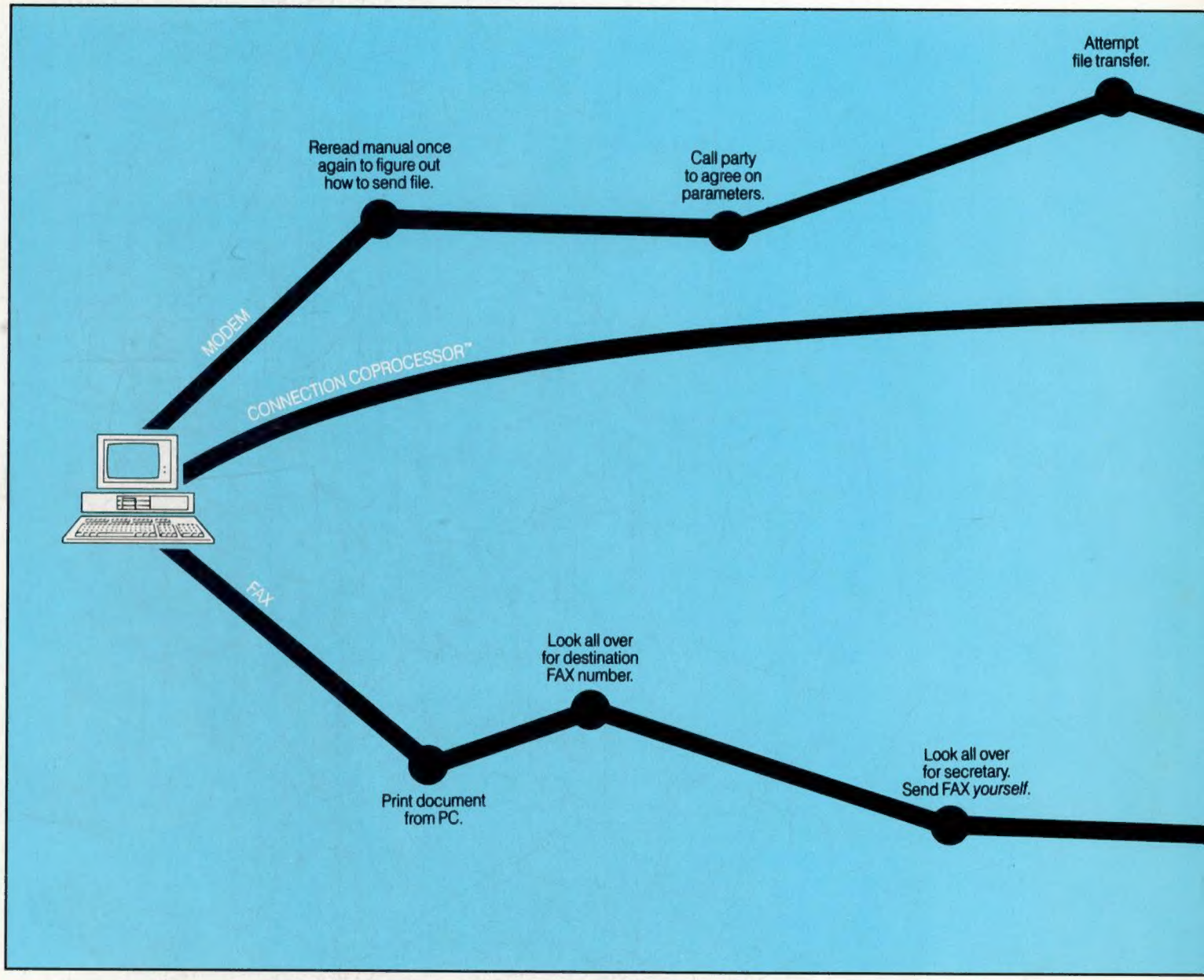
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- DOS and Unix: Marriage of Convenience?
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 6 PostScript Add-in Boards
 2 HP Speedup Boards
 Plus Free PC Magazine Printing Utility
- What IBM Forgot to Tell You About Presentation Manager

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Announcing the first non-stop communications route between businesses anywhere in the world.

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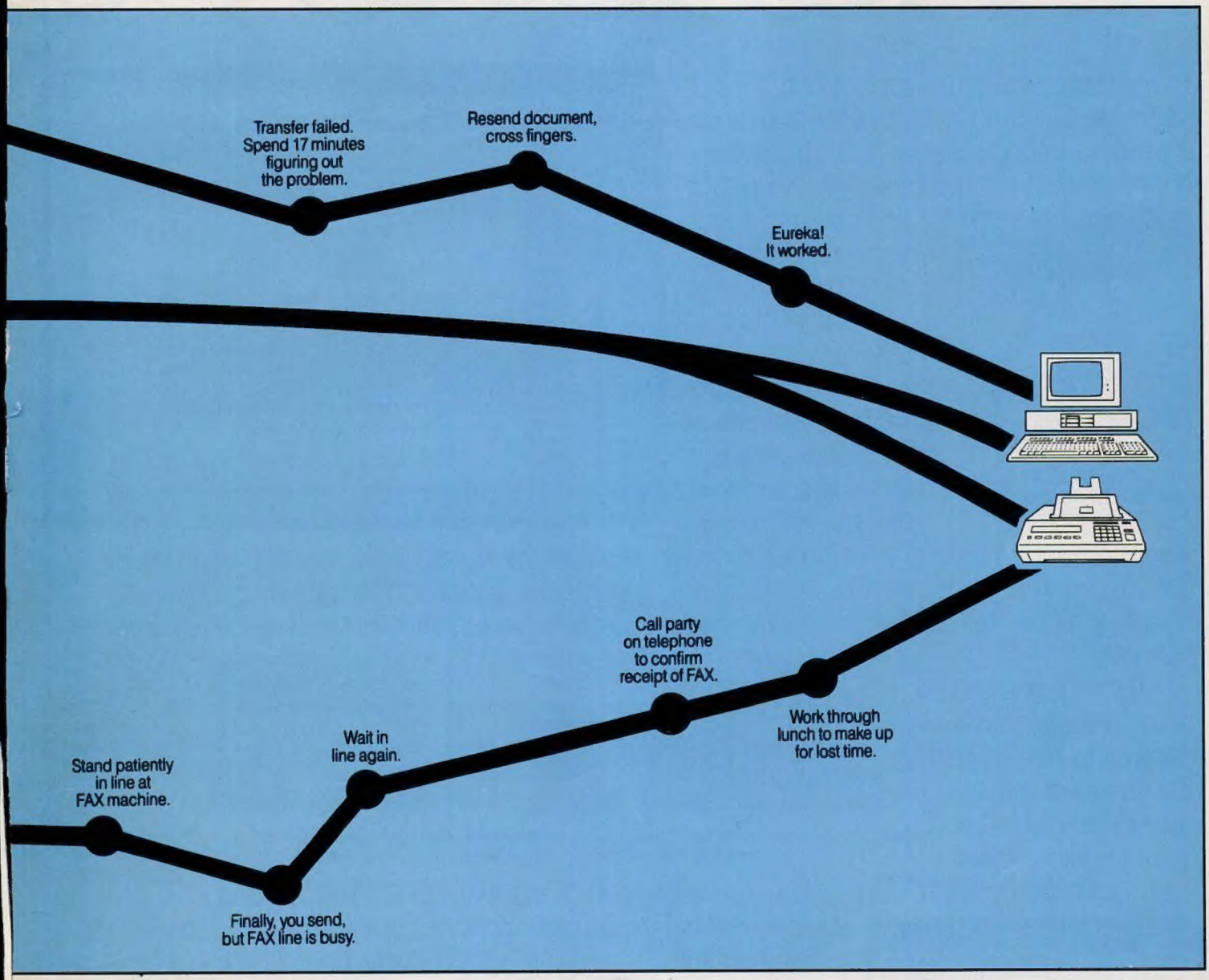
And when you fax, there are no more stopovers at the printer, or cooling your heels in line at the fax machine. Because Connection lets you do everything without leaving your PC.

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another Connection-equipped PC, you won't have to fiddle around with modem parameters or protocols. Because the Connection CoProcessor sets them for you. At 9600 bps.

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And everything is backed by toll-free technical support and a five-year warranty from Intel.

So what are you waiting for? Call 800-538-3373 now for a free demo disk.

Because with Intel's Connection CoProcessor, communication is really going to take off.

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CIRCLE 297 ON READER SERVICE CARD

This is abou

At this moment, millions of Lotus® 1-2-3® users are faithfully awaiting the arrival of a product called Release 3. A character-based product that promises greater power and greater productivity for serious spreadsheet users.

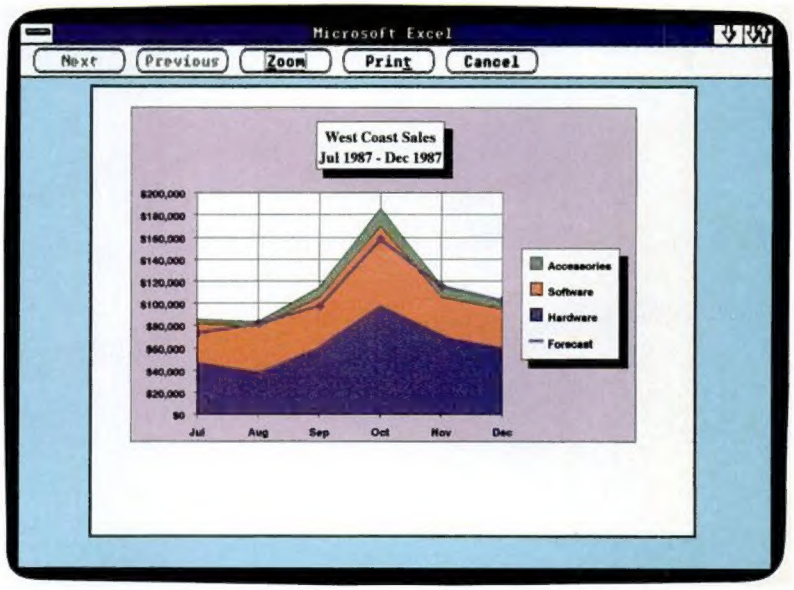
As soon as it gets here.

In the meantime, we have a question:

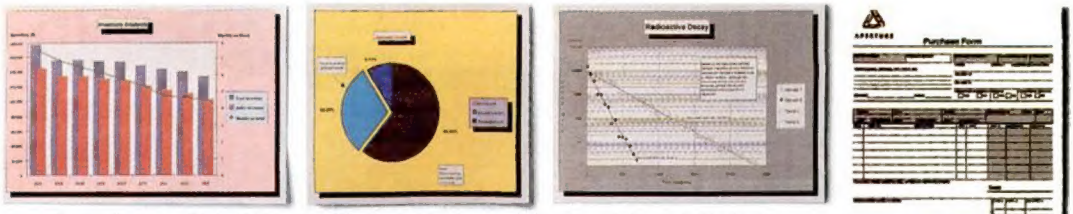
If Release 3 is in fact character-based, and the entire personal computing industry continues moving toward *graphics*-based environments, is it wise to wait for Release 3? Or consider the alternative.



Microsoft Excel. Or, how to see Lotus 1-2-3 Release 3 from a whole new perspective.

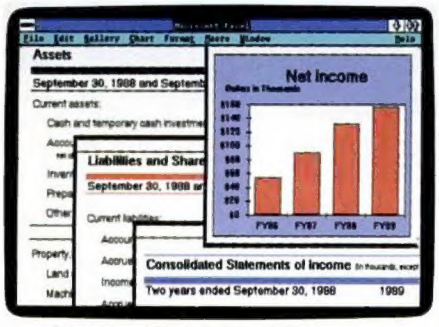


Actually, you can do both. Because you have nothing to lose by seeing the other side of the spreadsheet story, and trying it for yourself.



As you know, with 1-2-3 your ability to customize worksheets and charts is limited. As you may not know, with Microsoft Excel the possibilities are limitless.

It's called Microsoft® Excel. The spreadsheet specifically designed for graphic environments—the industry's emerging standard. Five minutes in front of a demo will show you the fastest, easiest, most enjoyable way to crunch your numbers. Thanks to an incredibly intuitive design that exploits innovations like Microsoft Windows, OS/2 Presentation Manager and, of course, the Macintosh®.

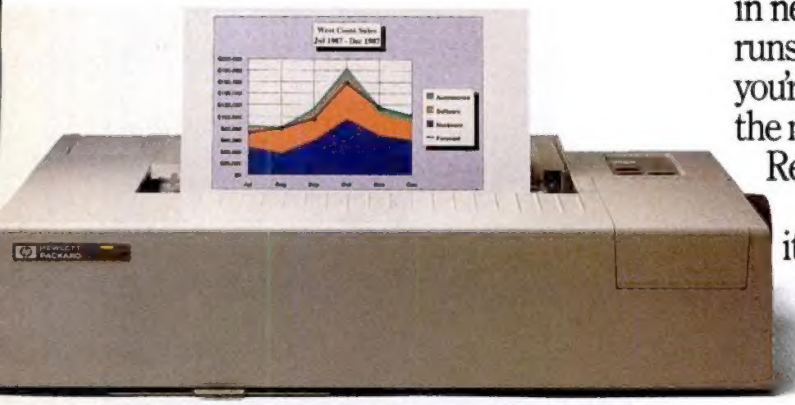


Unfortunately, 1-2-3 won't let you move, size, and link an unlimited number of files at the same time. Fortunately, Microsoft Excel will.

You're a loyal Lotus user. If you're a bit skeptical, we fully understand that. We also anticipated it. So we've made sure your hard-earned equity in 1-2-3 is not obsolete. In fact, we've not only made a transition to Microsoft Excel attractive, we've also made it easy: Microsoft Excel actually reads and writes

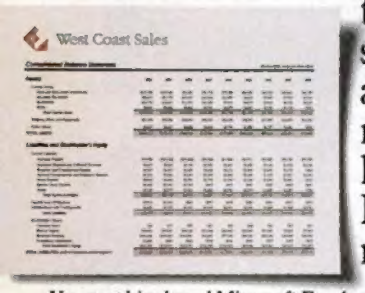
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t Lotus 1-2-3.



No more wasted trips to the printer. Microsoft Excel comes with Print Preview for true WYSIWYG. Unlike Release 3.

1-2-3 files and even helps translate macros. It also offers the convenience of 1-2-3 on-line help—so you can expect a surprisingly smooth transition. In fact, the slash key you punch to access your 1-2-3 commands is the same key that can access Microsoft Excel commands—you don't have to relearn a thing.



Yes, graphics-based Microsoft Excel was designed around a mouse. You can also use it without one.

Another issue: hardware.



As Lotus may or may not have told you, Release 3 will need a substantial investment in new hardware. The same hardware that runs Microsoft Excel. All we're saying is, if you're committing to new machines, make the most of those new machines. Something Release 3 simply won't.

But, using is believing. So we've made it convenient to get a sample of Microsoft Excel in your hands. Simply call us at (800) 541-1261, Dept. J14 for a free sample disk of your own. It's worth the call. It's worth the experience.

In fact, we're so confident about Microsoft Excel that we're offering a no-questions-asked, money-back guarantee good through January 1990. Which means we're actually willing to guarantee our current technology against Lotus technology that isn't even available yet.



For even more convincing, call for a sample disk. The disk is free. But the experience is priceless.

All of which brings us to a decision millions of you are about to face:

Upgrade to character-based Release 3, or upgrade to the power and simplicity of a graphics-based spreadsheet. We're not saying it's an easy decision.

Just an inevitable one.

Microsoft

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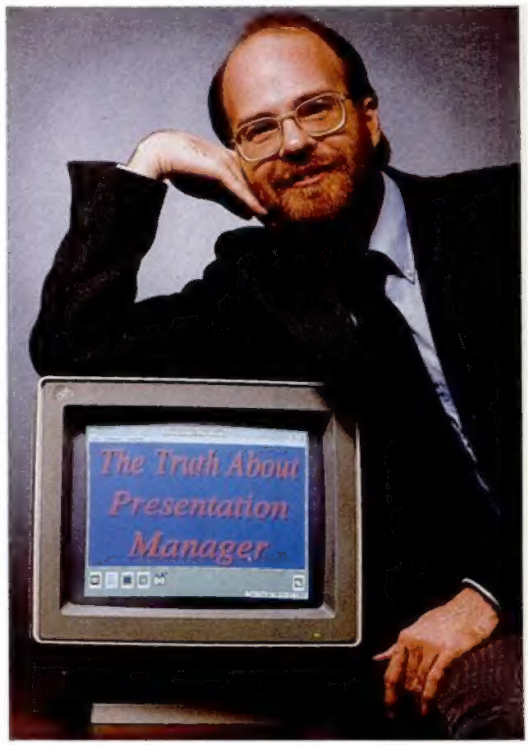
There's a visionary in some people all of the time, and in all people some of the time—especially when it comes to choosing tomorrow's systems. As many PC users question whether to make the move from DOS to OS/2, *PC Magazine*'s coverage of this controversial operating system will continue to focus on issues relevant to both end users and programmers.

In the spirit of forward thinking, we're not suggesting that you rush out and buy OS/2 today or even this year. Instead, we've asked contributing editor Charles Petzold—whose Environments column is the first ongoing series devoted to OS/2 programming to appear in any magazine—to write an article about the future of PC application software. That story has been influenced by a dramatic change in the modes of interaction between user and computer, culminating in a more inviting entrée into computing: the graphical user interface (GUI). For OS/2, that means the Presentation Manager.

Although the PM was released officially only recently, it's not new to Petzold. As the author of the book *Programming the OS/2 Presentation Manager* (Microsoft Press, 1989), he was the first journalist to see this new GUI before it went public, and he has been writing programs for it for more than a year.

Petzold describes the rationale for centering Environments on programming for the PM this way: "Because the PM is the primary environment for future OS/2 applications, programmers should be looking at PM the earliest. They're the ones who have to write the applications that the rest of us will use." The viability of OS/2 depends on programmers' getting their education now, because the operating system will become useful to most users only when a sufficient number of PM applications exist.

Just as programmers should find Petzold's column a harbinger of the new world of object-oriented environments, end users should find his feature article in this issue an invaluable introduction to concepts that are likely to determine the look and feel of the next generation of applications. With this kind of reporting, no one can say we haven't done our part to prevent the future from arriving prematurely.—**Robbin Juris** PC

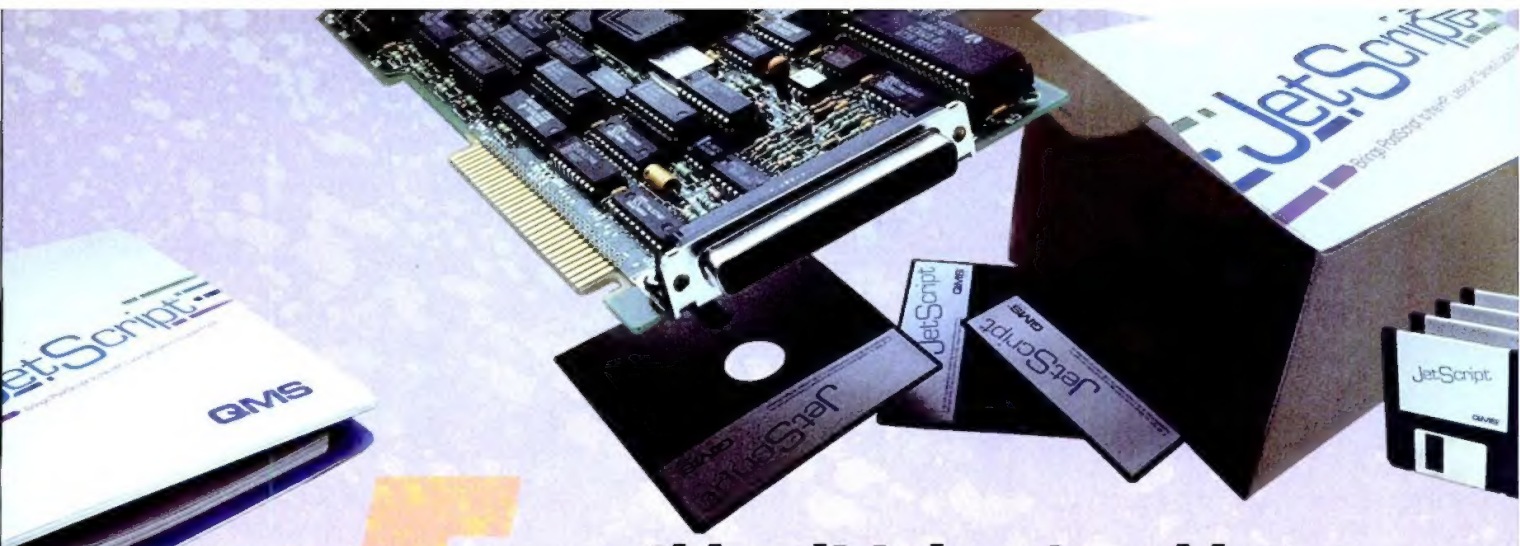


Contributing editor Charles Petzold created the opening art for his article by writing a PM program.

Photograph: Thom O'Connor

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Sept. 19, 1988

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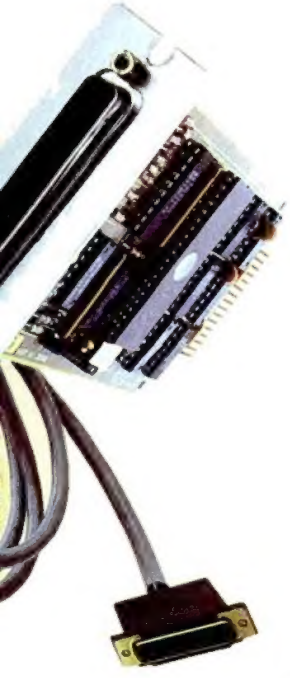
Simply, PostScript opens up the full range of possibilities for desktop publishing. You have complete control over the final look of the page, down to the last exacting detail. PostScript allows for an infinite number of font variations and sizes. That makes PostScript's limitless flexibility and power the perfect complement to your LaserJet Series II, giving you the high-quality output you require.

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PC MAGAZINE®

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M. David Stone/ The fax machine has changed the way people do business, and the partnership of PC and fax promises to achieve more than either technology can offer alone. With streamlined software, enhanced performance, and improved communications functionality, the 15 systems tested here show that PC-based fax packages are coming of age—to the benefit of PC users and businesses the world over 94
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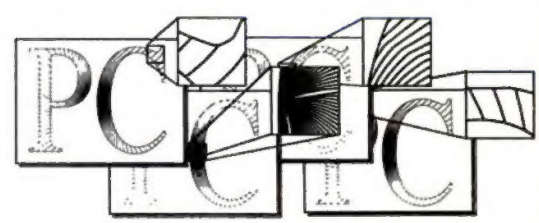
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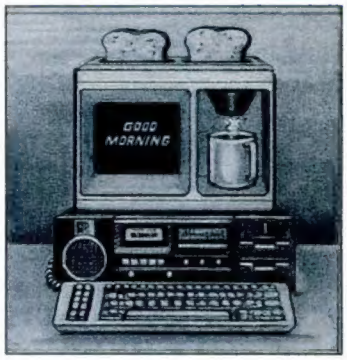
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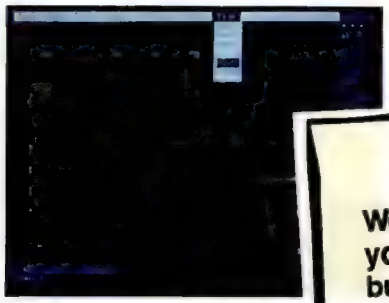
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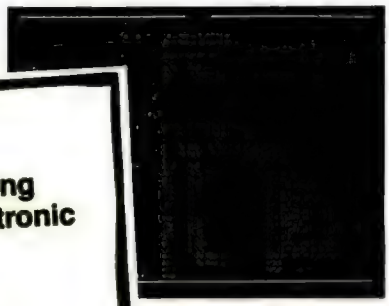
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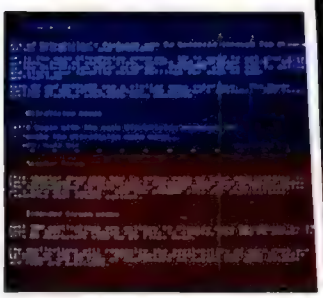


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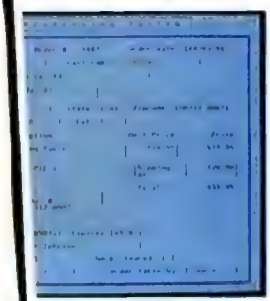




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	175 MB ESDI	$3295	$3395	$4395	$6395
VGA Color	40 MB 1:1	[illegible]	[illegible]	$4295	$6795
	80 MB 1:1	$2995	$3195	$3995	[illegible]
	115 MB ESDI	$3295	$3395	$4295	$6295
	175 MB ESDI	$3495	$3595	$4595	$6595
PRO VGA Color	40 MB 1:1	$2895	$2995	$3895	$5995
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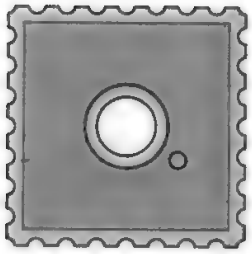
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LETTERS TO PC MAGAZINE



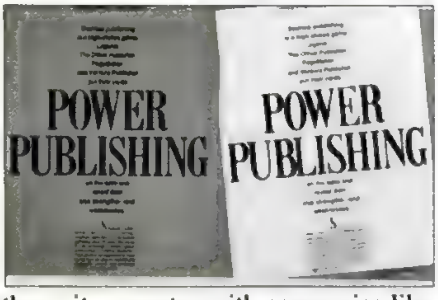
COMPARING APPLES AND IBMS

I can't believe Jim Seymour gave the Apple LaserWriter IINTX his endorsement ("The Best of 1988" *PC Magazine*, January 17, 1989). It is a great printer, but only for Mac users and PC users with AppleTalk (a.k.a. LocalTalk) boards. Like the original LaserWriter, it doesn't even have a parallel port, which is Apple's backhanded slap at anything IBM.

Steve Roth
Seattle, Washington

THE NEXT WAVE IN PUBLISHING?

Bestinfo should not be mentioned in the same breath as desktop systems ("Power Publishing," *PC Magazine*, December 27, 1988). Bestinfo does not compete with



them; it competes with companies like Atex, Penta, and Xyvision.

Perhaps it is useful in discussing Bestinfo to eschew the term "professional desktop system" and use the term Fourth Wave publishing system. The Fourth Wave, as described by the *Seybold Report*, stands for a new generation of systems that perform functions on mainstream platforms instead of expensive proprietary platforms.

Jim Bessen
President and CEO
Bestinfo Inc.
Media, Pennsylvania

LOOKING BACK, LOOKING AHEAD

Your end-of-the-year issue was great. The millennium has arrived: John Dvorak rightly labeled the AT bus an "old zombie," and *PC Magazine* recognized that the Micro Channel bus is a genuine technical advance—not just a marketing ploy. I loved it!

Peter H. Strong
Los Angeles, California

ENTERTAINING DVORAK

John C. Dvorak's critique of certain IBM employees' social graces, followed by his comments about SAA ("My Dinner with IBM," *PC Magazine*, January 31, 1989), raises questions about his objectivity. What does it take to favorably impress a computer columnist? I am not a big fan of many of IBM's recent actions and I agree that IBM is not the best business entertainer in the industry, but so what?

It is not their business, nor that of any other vendor, to entertain computer columnists. Would Dvorak's stated dislike of the Micro Channel architecture and IBM itself have been mollified by a good steak, a bottle of wine, and pleasant conversation (all free, of course)?

Mark Tucker
East Montpelier, Vermont

I do not always agree with John C. Dvorak, but I must say that he was correct in his observations on IBM. Most IBM employees do have more class and tact than those Mr. Dvorak encountered at dinner. But, in Big Blue's drive for greater profits, a school of thought has formed in the heart of its market-driven management that puts little value on personal relationships. Instead, getting the job done, regardless of cost, is the first priority.

These people have either forgotten, or were never taught, that professional etiquette begins with personal etiquette. Not only is it an honor and a privilege to have the mealtime company of another, but it is the obligation of the party extending the invitation to pick up the tab. There is a difference between playing hardball like a sportsman and playing hardball like a prima donna athlete. Some of the people who work for IBM should be sent down to the minor leagues.

David N. Heller
Reston, Virginia

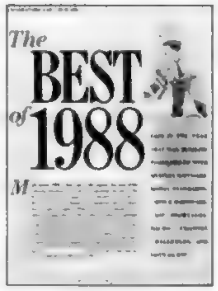
STRAIGHT TALK ABOUT DRIVES

Your writers communicate valuable information in a most effective manner. I needed to know more about the hard disk drive in the Model 30 286 ("What's Old Is New," *PC Magazine*, January 17, 1988), and your article contained all the information I needed and then some.

George E. Remp, Jr.
Upper Darby, Pennsylvania

WHY NOT SHAREWARE?

I feel you committed a great injustice by not mentioning shareware in your list of awards and kudos ("The Best of 1988"). Not everyone requires the ultimate product from some distant software house that cannot or will not support the user. For most of us, shareware is an excellent route to greater productivity.



James R. Plosay
Monterey, California

"A word cruncher's dream" PC Magazine
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■ LETTERS

TIARA LANCARD DESERVES BETTER

I can't believe the short shrift Frank Derfler gave the Tiara LanCard E ("Building Workgroup Solutions: Ethernet Cards," *PC Magazine*, January 31, 1989). The 8-bit LanCard is the throughput equal of the fastest 16-bit board. Its degradation from zero to four stations is a remarkable 7 percent, and it's faster over four stations than any other 8-bit card with zero stations.



Michael Friedlander
Ossining, New York

CLIPPED AGAIN?

Bill Machrone's kudos for the Curtis Clip were premature ("The Best of 1988," *PC Magazine*, January 17, 1989). There's no spring in the clip, so after you've tucked a couple of sheets of paper under it a couple of times, single sheets fall off. And, of course, the more sheets you use each time, the more it needs the next time.

This product is another example of American marketing: build it, hype it, and sell it. Let the public discover that it doesn't work. By then, the company's been bought out and the executives have floated to their Caribbean cabanas on platinum parachutes.

Ron Rodriguez
Lafayette, California

SEND ME A LETTER

What's all the fuss about printing envelopes on a LaserJet ("Printing the Perfect Envelope," *PC Magazine*, December 13, 1988)? Why all the ink for special programs and utilities?

I use a Wang PC and a LaserJet to print #10 envelopes and have never had a problem. I position the cursor on the first letter of the inside address and Enter GL + E. The macro picks up the inside address, drops it on the last page of the document, adds the correct number of returns to position the copy, and prompts me to change the left margin to 70 when printing. Perfect every time.

Peter Obletz
New York, New York

NON-TECHIES NEED HELP, TOO

Although your magazine contains very useful information, I feel that some of your articles tend to assume that the reader is already a technical expert on the topic under discussion. I would like to be able to gain new information from your articles, not just enhance my existing knowledge.

Lori Trawick
Montgomery, Alabama

CONNECTIONS GET YOU SO FAR

The two-edge connector board issue sounds like a nightmare to John C. Dvorak ("EISA Come, EISA Go!" *PC Magazine*, December 27, 1988), but unless I must plug and unplug a board each time I boot up my computer, I'm not going to worry about it. In the 2 years that I've had my AT system, I've only opened it twice and unplugged a board once.

■ The Wells modular system is a quantum leap in hardware refinement, taking removable backplane technology in desktop publishing to its logical conclusion.

Why doesn't Mr. Dvorak design and produce his own board, and we'll see who follows him?

Rick Carlson
Meriden, Connecticut

I DON'T DO WINDOWS

Stephen Manes really hit home ("New Versions, Old Pains," *PC Magazine*, October 11, 1988). Most so-called upgrades now favor windows. This is fine for illiterates, but when one learned computing with only 16K of BASIC and 16K of RAM, a window is wasted memory. I'll stick with my uncluttered screen.

Walt Stevenson
Pittsburg, Kansas



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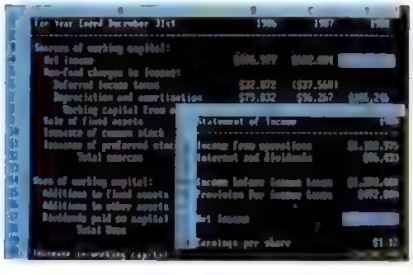
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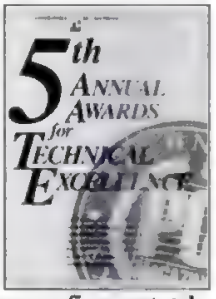
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■ LETTERS

THE MISSING AMERICAN

I am very surprised at your choice of top desktop system ("5th Annual Awards for Technical Excellence," *PC Magazine*, January 17, 1989). I do not think that the ALR cache technology was sufficiently unique to rate first place. More importantly, the Wells American CompuStar was completely ignored in the runners up categories.



The Wells modular system is a quantum leap in hardware refinement, taking removable backplane technology in desktop publishing to its logical conclusion. The Wells American organization is just that—American—and deserves all our support for their innovative approach and high-quality output.

Bill Copenhaven
Richmond, California

SMART MONEY

I have to question how closely Donald Trivette evaluated all three products before he chose *MoneyMate* to be the "real star" and "buy" of the three personal finance packages reviewed in After Hours, *PC Magazine*, December 27, 1988. I have used *Home Finance System III* since its introduction and consider it a smart software system that uses fast assembly language to incorporate unique design features that were not even mentioned.

Roy H. Andree
Lake Ronkonkoma, New York

■ *PC Magazine* is a constant source of helpful information. The only addition I can think of would be a swimsuit issue.

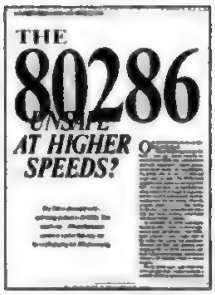
THANKS FOR EVERYTHING

I would like to thank everyone at *PC Magazine* and PC MagNet for their wonderful magazine and BBS. *PC Magazine* is a constant source of helpful information. The only addition I can possibly think of would be a swimsuit issue.

John Rago, Jr.
Moccasin, California

BUT DOES IT RUN OS/2?

I was very disappointed that your review of 286 machines ("The 80286: Unsafe at Higher Speeds?" *PC Magazine*, December 27, 1988) didn't test for OS/2 compatibility. Why was this claim not tested? It's a make-or-break point for me, as I would not invest in a machine that didn't run OS/2.



Andy Klein
Glendale, Arizona

I NEED MY SPACE

For many of your readers, *PFS:First Choice* is the last choice ("The Best of 1988"). I do my work on a Zenith laptop with no hard disk, and I find that the size of *First Choice* gets in the way of its use. With its .EXE file as well as all the overlays, the program requires two disks exclusive of data files. For now, I'll stick to *Microsoft Works* for my integrated program because it's functional and fits on one 720K disk with its spelling checker.

Richard B. Thomas
Tacoma, Washington

CORRECTIONS/AMPLIFICATIONS

The new Intel 80386SX processor is 16 MHz, not 12 MHz ("Take It or Leave It: Portables with Desktop Power," *PC Magazine*, October 11, 1988).

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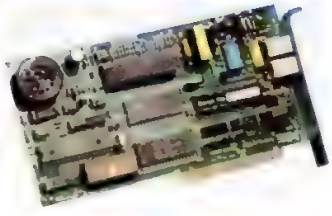
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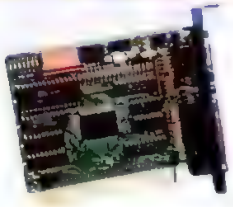
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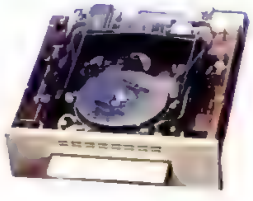


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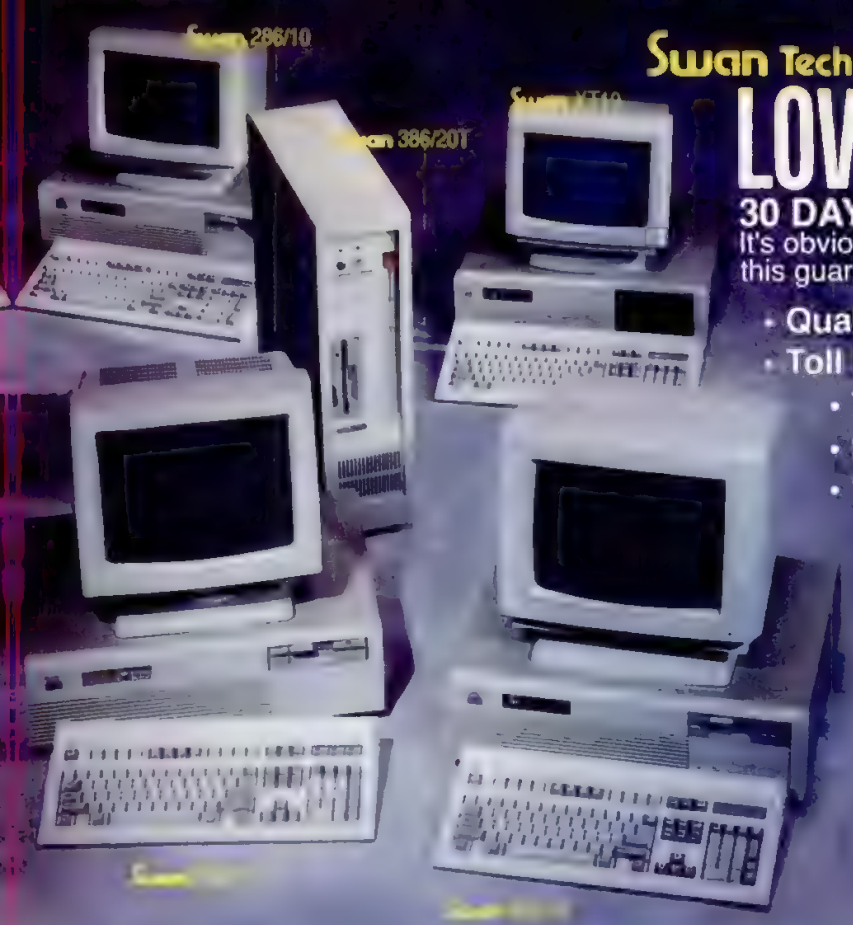


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Standard Memory	640K	512K	512K	1MB	1MB
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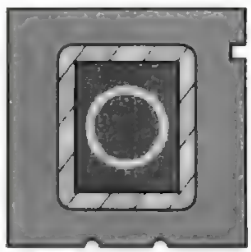
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CIRCLE 233 ON READER SERVICE CARD

■ JOE DESPOSITO

PC ADVISOR



Help in finding software to beef up a laptop cursor, locating an inexpensive black-and-white monitor, filling a need for voice mail telemarketing, and upgrading from XT to AT.

THE CASE OF THE LOST CURSOR

I am looking for a way to change the default cursor style on my Zenith SupersPort 286. The cursor blink rate is fairly close to the LCD response time, so the cursor stays very faint. I would like to change it to a solid block cursor or slow down the blink rate, anything but what I have right now. The problem is exacerbated when I am using a word processor or spreadsheet. The cursor gets totally lost in the clutter. Do you know of any way to get around this problem?

Gopal Miglani
Des Moines, Iowa

A product called No-Squint Laptop Cursor from SkiSoft Publishing (1644 Massachusetts Ave., Lexington, MA 02173; (617) 863-1876) can help you with your problem. This $39.95 utility was reviewed in First Looks, page 56, PC Magazine, *December 13, 1988.*

BLACK, WHITE, AND READ ALL OVER

Can you please tell me how to get an IBM PC and/or AT clone to display black text on a white background without getting into the desktop publishing business? I just want my wife's plain-vanilla (and somewhat obsolete) word processor to put black text on a white screen (like ink on paper). Surely there is a video card/monitor combination that will do this. (I know about using ANSI.SYS to give inverse video. That works fine as long as you're in DOS.) I'd appreciate any suggestions you can offer.

Jerry D. Robertson
Signal Mountain, Tennessee

In the March 29, 1988, issue of PC Magazine, *there was an article entitled "Black-and-White Monitors: The Designer Collection." Of the 14 monitors reviewed, most (13) were for people with serious desktop publishing concerns. The cost of these monitors (or monitor/video board combinations) ranged from $999 to $2,620. From what you say in your letter, I don't believe any of these products are what you are looking for.*

One product in that roundup, the NEC MultiSync GS, from NEC Home Electronics (1255 Michael Dr., Wood Dale, IL 60191; (312) 860-9500), received the comment "is clearly out of its league among these high-resolution giants," but it seems to fit your needs perfectly. It will give you the black text on a white background that you are looking for and will work with any IBM graphics adapter, from CGA to VGA (and Hercules graphics, too). Considering the suggested retail price of just $279, this is an economical way to get the display you want without asking your wife to switch to a word processor that allows control of background and foreground colors.

■ Can you please tell me how to get a PC to display black text on a white background without getting into the desktop publishing business?

VOICE MAIL TELEMARKETING

Are you aware of any products that can perform the following operation (or something similar)? A customer in need of pricing information places a telephone call to a business. A PC answers the call with a recorded message that prompts the caller for a product part number. The caller enters the part number via a touch-tone telephone. The PC references a *dBASE III Plus* database file to locate the price and verbally relays the price to the caller.

David C. Perry
Wilmington, Delaware

In the January 17, 1989, issue of PC Magazine, *there was an article entitled "Replacing the Receptionist: PC-based Voice Mail Systems." Of the nine products reviewed, three are capable of inbound telemarketing, which is the application that you are describing. An inbound telemarketing feature means that a voice mail product can prompt users, record messages (typically in the form of orders), and dispense information.*

Of the three products, two are for single-line systems and one is for multiple-line systems. For single-line systems there are BigmOuth from Talking Technology (4383 Piedmont Ave., Suite B, Oakland, CA 94611; (415) 652-9600) at a suggested retail price of $269, and Watson from Nat-

■ PC ADVISOR

ural Microsystems (8 Erie Dr., Natick, MA 01760; (617) 655-0700) at a suggested retail price of $199. For multiline systems there is VBX System, also from Natural Microsystems, at a suggested retail price of $3,995.

To do what you want to do with the system, you'll have to do some programming. For example, Talking Technology sells a Programmer's Development Package, which you can use to tailor the operation of BigmOuth to your specific needs. The package will work in conjunction with any language that can call a software interrupt, such as BASIC, C, Pascal, and assembler. This toolkit costs $79 ($339 when purchased with BigmOuth). Additionally, if you are not an accomplished programmer, Talking Technology sells The Interpreter, a proprietary language that makes it easier to develop custom applications. The Interpreter costs another $79 (or $399 for all three).

NOT LEAVING THE PAST BEHIND

I own an IBM PC-XT clone that has 640K of memory, CGA board, game port, serial port, 2,400-bit-per-second internal modem, two 5¼-inch floppy disk drives, and a Seagate ST138R hard disk drive. My question is, since I want to upgrade to an AT, what hardware will I be able to salvage from my current system? I would also like to know if my current RAM chips would be usable in an AT motherboard, and can 8-bit add-on cards be plugged into 16-bit slots?

Joseph Baccellieri
Staten Island, New York

Since the IBM AT bus is an extension of the IBM PC-XT bus, 8-bit boards usually work fine when used in an AT. Therefore, your CGA board, ports, and modem should all work in the AT. The Seagate ST138R will work in the AT, and most XT hard disk controllers will work, too, but the penalty you pay is slow performance. If the controller works, your floppy disks will work, too.

As for the RAM chips, 150-nanosecond chips should be used only in ATs that work at speeds of 8 MHz or slower. If you are upgrading to 10 or 12 MHz, the chips will not be fast enough. Your best bet is to purchase 100-ns. chips. Also, your XT motherboard may have some 64K chips and your AT board may require 256K chips.

The only other problem you may have is with the keyboard. If your keyboard is one of the switchable types, just switch to the AT setting and the keyboard should work fine. Otherwise, you'll need a new one.

ASK THE ADVISOR

Send your questions to PC Advisor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload to PC MagNet (see the Productivity section for access information). Please specify your equipment. PC

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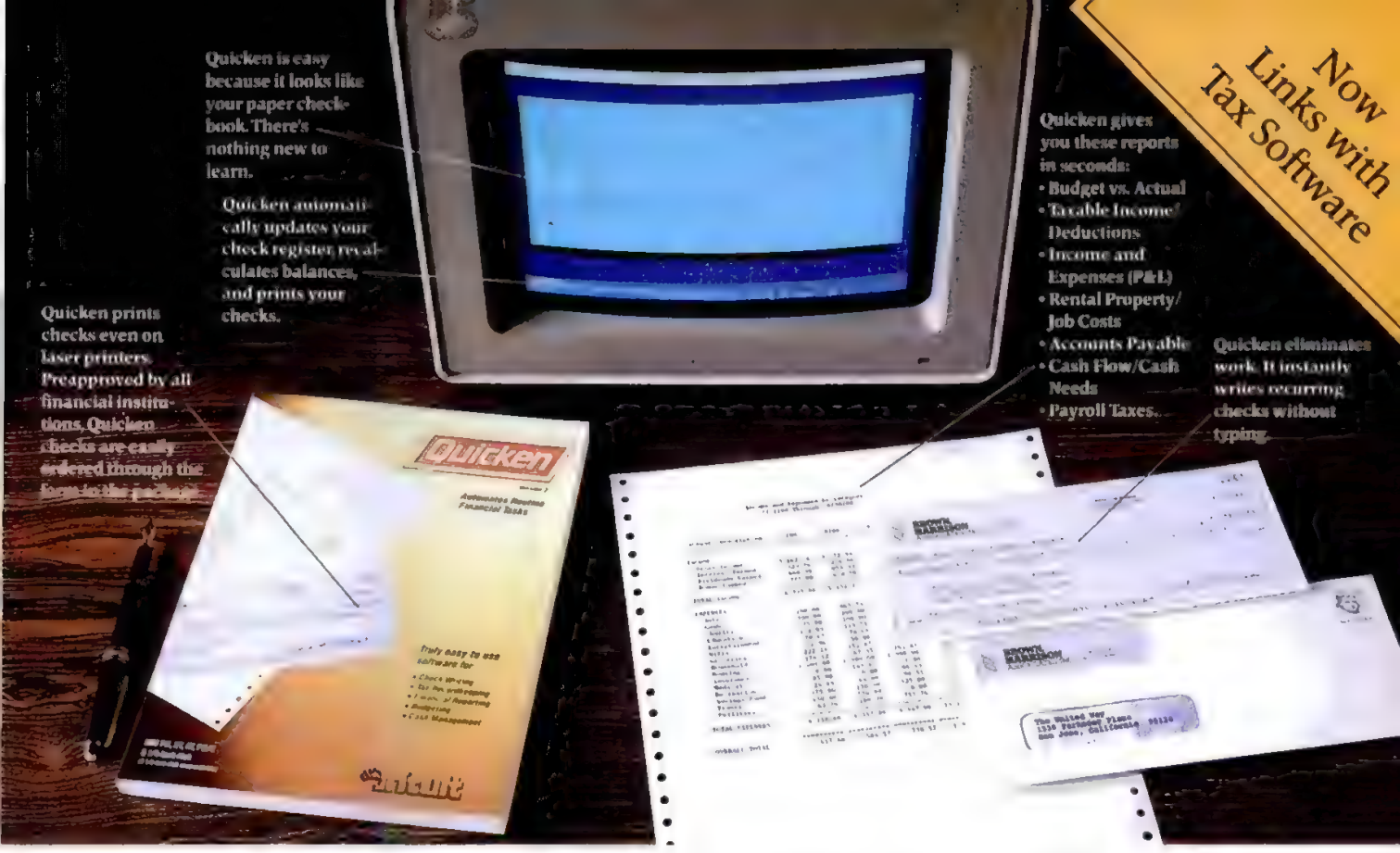
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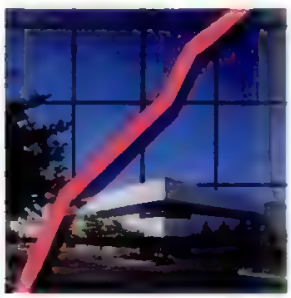
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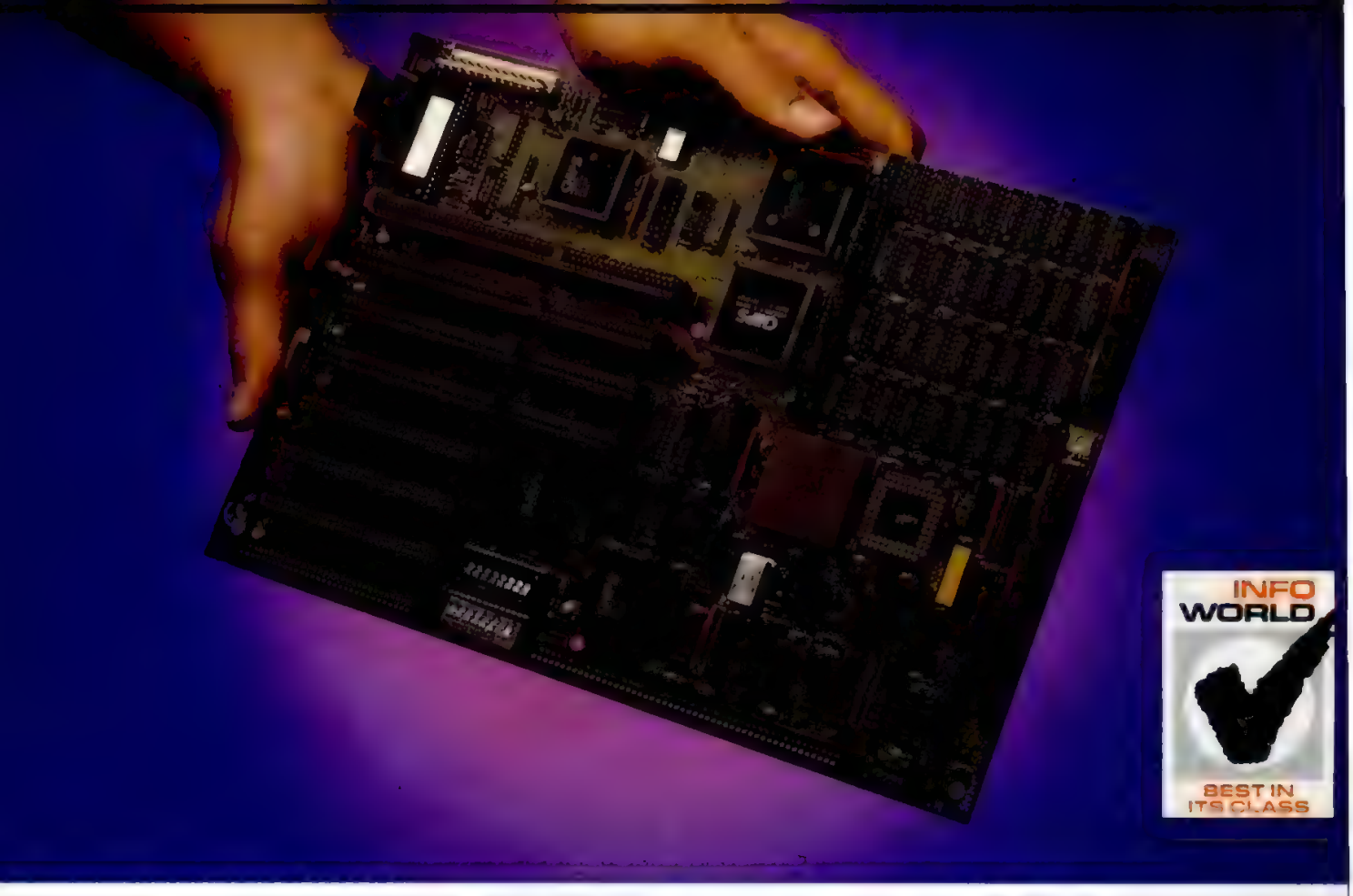
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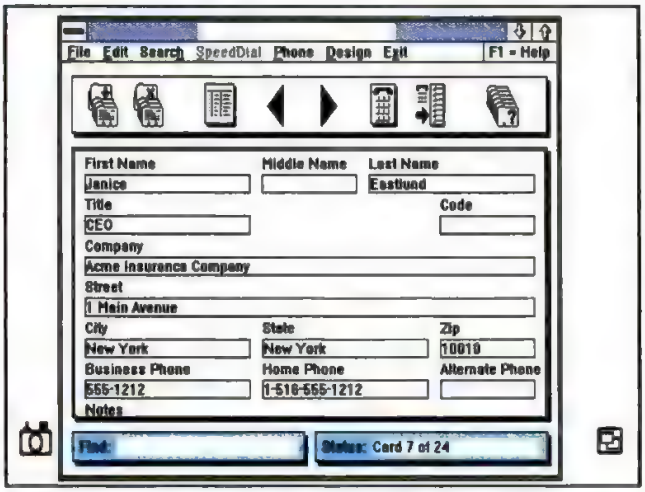
SideKick for Presentation Manager: A Glimpse at Applications to Come

PC HANDS ON

BY CHARLES PETZOLD

The OS/2 Presentation Manager is off to a great start with its first available application—none other than Borland's *SideKick*. IBM is bundling *SideKick* with new copies of OS/2 1.1 and updates from OS/2 1.0. The deal is currently scheduled to extend through June.

SideKick for Presentation Manager is quite different from the DOS *SideKick*, originally released in 1984 and still one of the most popular RAM-resident pop-ups. Completely overhauled and rewritten, the Presentation Manager version makes such a leap over the DOS *SideKick* that the two packages have little in common except for the name and concept. You'll also find none of the strange under-the-cover tricks that characterize DOS pop-ups.



The Phonebook and Appointment Calendar of SideKick for Presentation Manager *generate files compatible with Borland's* Paradox.

Beyond Convenience

In the Presentation Manager, every program is a pop-up, so a PM program must offer more than mere convenience. The ideal PM program is interactive and easy to use but also has some powerful features that remain unobtrusive until you need them. For the most part, this is

(continues on page 35)

SuperCalc5 Mimics 1-2-3, Links And Displays Multiple Worksheets

PC HANDS ON

BY M. DAVID STONE

Most users recognize three classes of spreadsheet program: *1-2-3* as the standard, *Excel* as the leader of a new generation, and everything else. *SuperCalc5* ($495) is Computer Associates International's latest bid to break out of the "everything else" category.

The Computer Associates strategy is simple: provide a new-generation spreadsheet that anyone familiar with *1-2-3* can use immediately, that does some things—notably graphics—even better than *Excel*, and that can be run on computers that would be painfully slow in using *Excel*'s graphics interface. In short, with *SuperCalc5*, the battle of the new-generation spreadsheets has begun.

The laundry list of new features in *SuperCalc5* ranges from minor conveniences such as the Undo command to important new-generation features such as the ability to link spreadsheets and display multiple spreadsheets on-screen. Other features include three-dimensional graphics, a set of Audit commands for troubleshooting spreadsheets, and support for PostScript printers, cartridge-based LaserJet fonts, and multiuser operation on several networks.

One of the most notable changes in *SuperCalc5* is what Computer Associates terms coexistence with *1-2-3*. In some cases this translates to slicker handling of a function that was already in *SuperCalc*. For example, where *SuperCalc4* could import and export *1-2-3* files, *SuperCalc5* can deal with .WKS and .WK1 files directly, loading them, saving them, and otherwise treating them as an alternate *SuperCalc* format. You can even set the program to use .WKS or .WK1 as the default.

In other cases, coexistence with *1-2-3* translates into a new feature that makes *SuperCalc5* easier for a *1-2-3* user to learn.

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SuperCalc5

(continued from page 33)

In particular, there are the menus. By most standards, the *SuperCalc* menu structure is an improvement over *1-2-3:* most commands are easier to find and require fewer keystrokes than in *1-2-3*. But the need to learn a new menu structure has been a serious obstacle in getting *1-2-3* users to switch to *SuperCalc*.

Computer Associates' solution to the problem is simple—provide both choices. *SuperCalc4* users will find the menus they are already familiar with—along with a wealth of new options—in *SuperCalc5*, and Lotus converts can set the program to use the menus from *1-2-3*, Version 2.01. A supplied utility can convert *1-2-3* macros into macros that will work within *SuperCalc*'s *1-2-3* menus.

The one added choice on the *1-2-3* menus lets users venture into the *SuperCalc* menus. From there, you can perform a single command and then automatically return to the *1-2-3* menus. This not only gives users a way to get at the new features not available from *1-2-3* commands, but also offers a relatively painless way to learn the *SuperCalc* menus. You also can get to the *1-2-3* menus momentarily from *SuperCalc*'s native menu system, a real frustration saver for *1-2-3* users still trying to make the change.

Aside from its coexistence with *1-2-3*, *SuperCalc5*'s most important new feature is its ability to link spreadsheets. *SuperCalc5* gives you two ways to link spreadsheets. One choice is to create multiple pages within one file, with each spreadsheet on its own page. You can then read values from one spreadsheet into another. This three-dimensional approach lets you break a complex spreadsheet model into smaller sections, which are easier to troubleshoot and can be changed without worrying about accidentally affecting the others. This arrangement also lets you load all the spreadsheets at once.

The second way to link spreadsheets is to keep each spreadsheet in its own file. When using multiple files, you can read values from one spreadsheet into another with a formula that defines the file and cell to read from. This approach is the obvious choice if you want to collect reports from different departments or regions, for example, and consolidate the information into a single master spreadsheet.

Another important advantage of linking multiple files is that *SuperCalc5* can read data not only from *SuperCalc* files, but from .WKS and .WK1 files as well. In other words, you can actually link *SuperCalc* worksheets with *1-2-3* worksheets. With the multiple file approach, you can also link an active worksheet (in memory) with worksheets on-disk. You can even combine the multifile and multipage approaches.

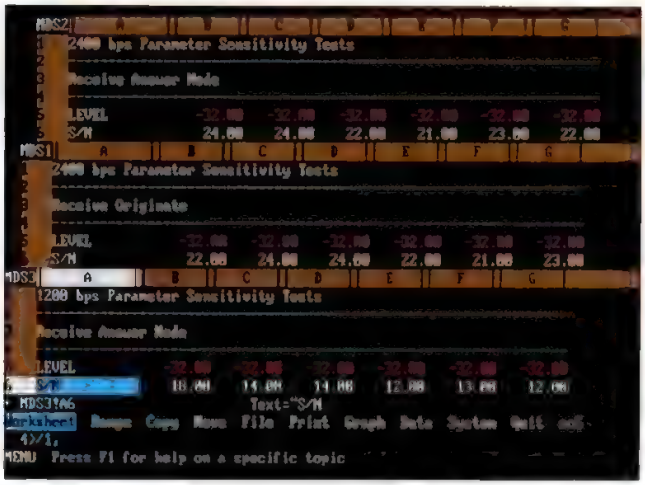
Whichever approach you choose, *SuperCalc* will let you link up to 255 worksheets. It will also let you view up to three worksheets at once and page through as many worksheets as you have in memory.

The new graphics options, including 3-D bar charts and line charts, put *SuperCalc5* on a level with some of the best standalone graphics packages. Even better is Computer Associates' overnight slide service (provided through MAGIcorp) for converting *SuperCalc5* graphics images to 35mm slides.

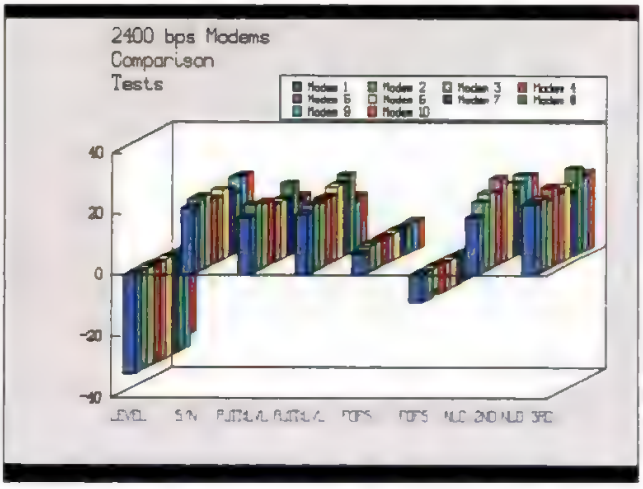
Also noteworthy is *SuperCalc5*'s potential for printed output. With the text printer defined as a PostScript printer, you can choose from all the standard PostScript fonts. Similarly, you can install the text printer as an HP LaserJet Series II and pick up to three cartridges and three soft fonts. Unfortunately, the program does not provide this level of support for all printers. With the Canon LBP-8II, for example, *SuperCalc5* doesn't support cartridges of soft fonts at all. Built-in graphics drivers are somewhat limited. However, *SuperCalc* can take advantage of external GCI drivers and comes with several, including some for specific PostScript printers.

Finally, there is the issue of hardware. Computer Associates is targeting the installed base of 8088 and 8086 machines, arguing that *SuperCalc5* is the only new-generation spreadsheet that can run at adequate speeds on older, slower computers.

True enough, but there are other good reasons for moving to *SuperCalc5*—particularly if you're already familiar with *SuperCalc4* or *Lotus 1-2-3* menu structures. Take a careful look. You may find that *SuperCalc5* is the preferred choice—even if you've already invested in a 386 machine. PC



You can display up to three worksheets simultaneously with SuperCalc5 *and link up to 255. Above, the worksheets are shown with the optional* Lotus 1-2-3*–like menus.*



SuperCalc5 *offers three-dimensional bar charts and line charts, along with an overnight service for producing 35mm slides.*

PC MAGAZINE FACT FILE

SuperCalc5
Computer Associates
International Inc.
1240 McKay Dr.
San Jose, CA 95131
(800) 531-5236
List Price: $495; upgrades free to members of Computer Associates' SupportPlus maintenance plan, $100 for other registered users and for registered users of competitive products.
Requires: 512K RAM (640K recommended), hard disk, DOS 3.0 or later. Not copy protected.
In Short: *SuperCalc5* adds *1-2-3* compatibility, along with an abundance of expansive new-generation features, such as the ability to link as many as 255 spreadsheets and display up to three spreadsheets simultaneously.

CIRCLE 458 ON READER SERVICE CARD

SideKick

(continued from page 33)

exactly how *SideKick for Presentation Manager* has been designed.

Take the Calculator, for example. It's a nice general-purpose calculator, including trigonometric functions, financial functions (present and future values), logarithms, and exponentials. Programmers will miss hexadecimal conversions, but this is not a programmer's calculator. You can use the mouse to "press" the calculator buttons, of course, and all the buttons also have keyboard equivalents. A "paper tape" maintains a record of the calculations.

In that sense, it's just a simple, easy-to-use computer calculator. But that paper-tape display is actually a rudimentary one-column spreadsheet. You say you typed an incorrect number 40 calculations ago? No problem. Scroll back the paper tape, double-click the entry, and reenter the operation and number. The new value ripples through the subsequent calculations. You can save the tape in an ASCII format, recall old tapes, and edit them to suit your whims.

The keyboard equivalents for the Calculator keys (and much other information) is available at any time from an SAA-style context-sensitive Help window. All the *SideKick* applications have this feature. You can keep the Help window on the screen while working with the program.

Mini Paradox

The Phonebook and Time Planner are the most-sophisticated *SideKick* applications. These are actually small database applications that draw on Borland's *Paradox* technology. *SideKick for Presentation Manager* includes a 287K dynamic-link library named PDOX .DLL, described in the header section of the file as "Mini Paradox." The programs create files that can be accessed, edited, and printed by *Paradox*.

The Phonebook is easy. You select New Card from the Edit menu (or click on the New Card icon) and type in the fields. Space is provided for a full address and for business, home, and alternative phone numbers. The entry is automatically alphabetized by last name and saved when you page to another card. By default each entry in the Phonebook occupies a full window, but you can also select a view that lists the entries one per line. You can search for a card by filling in a similar screen with selected information. As in any good database program, you can even redesign the Phonebook card layout.

The Phonebook has an automatic dialer that works with Hayes-compatible modems. Of course, OS/2 will prevent the Phonebook from interrupting another program that may currently be using the communications port.

The Time Planner is an appointment calendar with daily, weekly, and monthly views. Setting an appointment time is a little tricky at first. This was the only part of *SideKick* that required me to consult the Help window. You can set an alarm to remind you of appointments. The alarm uses a distinctive sound and a Presentation Manager message box. The message box won't be visible outside the Presentation Manager session, but the sound is still audible.

The Time Planner also has the most gratuitous feature in *SideKick:* you can tag appointments with any of a collection of tiny icons—a ship for travel, a wineglass for a party, a flag for national holidays . . . You get the idea.

The Notepad is the weakest part of the new *SideKick*. It has a search-and-replace and uses the Presentation Manager clipboard, but that's about it. It's limited to a 64K file length. The Notepad uses a monospaced Courier font rather than the default PM proportional font, but a pesky bug in its font selection logic causes it to use a stretched-out Courier font designed for the IBM Proprinter rather than one designed for the EGA or VGA.

I found a few other problems as well. For example, all four applications have .HLP files that contain the text for their Help windows. These should be resources that are part of the .EXE files. As it stands, the programs can't find their .HLP files when loaded from a different subdirectory.

In addition, most of the .EXE and .DLL files in *SideKick* are insufficiently segmented, boosting their memory consumption. Even with 4MB of memory, expect to wait while OS/2 clears out enough memory when you load a *SideKick* application.

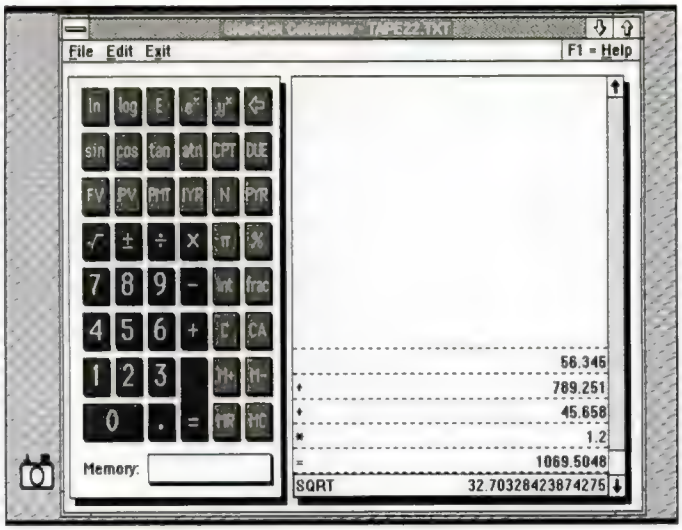
Finally, printing is rudimentary and doesn't use Presentation Manager facilities, so it's text-only and uses only the printer's built-in font. And you'll need to switch your PostScript printer to Diablo emulation mode or you won't get anything printed out.

I forgive Borland for these flaws, as irritating as they are. I know how much the Presentation Manager was changing in the final months of development, and I'm surprised that Borland was able to get this product out as quickly as it did.

Bottom Line

One of my first articles for *PC Magazine* was a feature review of the original *SideKick*. I liked it and used it. But a couple of years later, disgusted over the mess that had developed with RAM-resident programs under DOS, I removed *SideKick* from my system. Perhaps the simplest way to show how I feel about the Presentation Manager version of *SideKick* is to divulge that I'm once again a happy *SideKick* user.

Of course, *SideKick* isn't the mythical "killer app" that will induce millions of users to switch from DOS to OS/2. But *SideKick* does demonstrate the power of OS/2 and the Presentation Manager and, once Borland's programmers iron out the program's few kinks, it will be even more of an asset to those who make the switch to OS/2. PC



The SideKick for Presentation Manager *Calculator offers a "paper tape" you can scroll and edit. It automatically recalculates final values based on changes you make.*

PC MAGAZINE FACT FILE

SideKick for Presentation Manager
Borland International Inc.
1800 Green Hills Rd.
P.O. Box 660001
Scotts Valley, CA 95066
(408) 438-8400
List Price: $250; included free with IBM's OS/2 1.1.
Requires: 3MB RAM, EGA or higher, OS/2 1.1. (4MB RAM, VGA card, and mouse recommended.)
In Short: This all-new *SideKick* shows off the Presentation Manager and provides powerful functions underneath an easy interface. Includes Calculator, Phonebook, Appointment Calendar, and Notepad. Not copy protected.

CIRCLE 457 ON READER SERVICE CARD

Copyrighted materia

Data Junction 2.1 Adds Intelligence to Database, Spreadsheet File Conversions

PC HANDS ON

BY CRAIG STINSON

Data Junction, Version 2.1, formerly *DataPlex*, addresses two of the data processing manager's larger headaches: the need for efficient file-format conversion and the need to ensure valid data entry.

Modeled after the airline industry's hub-and-spoke strategy, *Data Junction* provides conversions to and from the following formats: *dBASE* (*II*, *III*, and *IV*), .DIF, *Lotus 1-2-3*, *Symphony*, *Paradox*, *Enable*, *FoxBASE*, *FoxBASE Plus*, *Framework* (*II* and *III*), *Multiplan*, *Reflex*, *SuperCalc*, *VP Info*, and *VP Planner*. The program also handles ASCII files in all forms (delimited, fixed, Macintosh), popular mail-merge formats (*WordPerfect*, *Microsoft Word*, *WordStar*), and mainframe and minicomputer data (EBCDIC, binary, and packed). A variety of binary numeric types is supported, including IEEE single- and double-precision floating point.

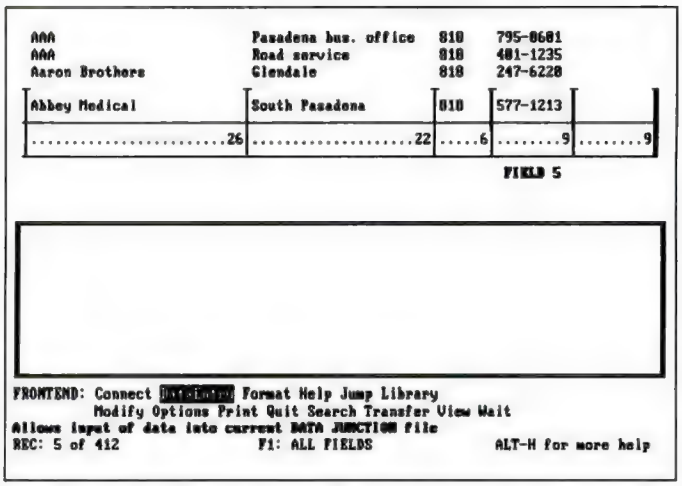
In all cases, conversion is a two-step process. Source data is first converted to an intermediate format (the *Data Junction* hub), then reconverted to the chosen output format. This approach makes *Data Junction* eminently expandable; Tools & Techniques can continue to add spokes as needs arise, without having to concern itself with the details of each possible point-to-point transfer. More important, it provides for a single interface by which to massage and filter data along the conversion path.

If users always wanted data to have exactly the same structure, content, and format on both ends of a conversion process, there'd be little need for a product like *Data Junction*. All popular database applications now provide their own simple conversion services—in and out of *dBASE* and *1-2-3*, at the very least. In the real world, though, data commonly needs a little massage in transit from one context to another. Fields may require alteration in alignment or width, some fields and records may need to be eliminated on the output side, and new records and/or fields may need to be grafted on.

The *Data Junction* hub provides a luxurious range of massaging and filtering services. Among other things, users can add, delete, reorder, and rename fields; specify filtering criteria to eliminate unwanted records; sort records on up to four fields; change field widths and alignments; carry out search-and-replace operations; and reformat dates, times, and other common data types. To facilitate these transformations, *Data Junction* provides a simple-to-use keyboard interface (modeled after that of *Microsoft Word*) and a context-sensitive help system.

Conversion filters and masks can also be encapsulated into script files for further streamlining. And for the ultimate in automation, the input and output file types and the script file can all be named on the DOS command line or stored in a batch file.

As important as these conversion capabilities are, though, they are not the whole story. The hub can also serve as a data entry system, and the company has gone to great lengths to make this aspect of the program functional and flexible.



Data Junction *lets you edit and massage files before you complete format conversion. During data entry, it automatically recognizes data types, field widths, and validation criteria.*

On the input side, *Data Junction*'s Autostyle feature relieves users of the need to declare data types, field widths, and validation criteria. The program doesn't worry about widths; it simply adjusts to accommodate the widest entry in each field. As for data types, *Data Junction* looks at your first record and matches each field with one of its 48 predefined data types. Thereafter, it provides validation services to ensure that each field in each record is supplied with the appropriate kind of data.

For example, if you enter 11/16/43 into a field in record 1, *Data Junction* recognizes that information as a date. In succeeding records, you won't have to type the slashes, and you won't be allowed to enter numbers out of the appropriate ranges.

The built-in Autostyle types include all manner of dates (numeric and spelled out); postal codes for the United States, Canada, and elsewhere; Social Security numbers; telephone numbers; and many other common formats. You can add your own styles and validation criteria, and you can add field prompting as well. Or you can turn the whole Autostyle business off, if you wish.

Both in file conversion and in data entry, *Data Junction* is designed to eliminate programming. It's able to do this because it doesn't offer screen forms or structured reports. What you get is an abstract table structure with a lot of built-in intelligence.

At first blush, the hub might strike some users as being too abstract for comfort. There's nothing fancy to look at here—no screen-painting, no pull-down menus, and only the most minimal effort at color support (you can choose between white on black, white on blue, and white on gray). And for some reason, *Data Junction* displays only four records at a time, reserving a large chunk of the screen as a static message area.

But the smarts behind the screen are pretty impressive—enough so that many users who buy the product solely for conversion purposes will find themselves using it as a data entry tool as well.

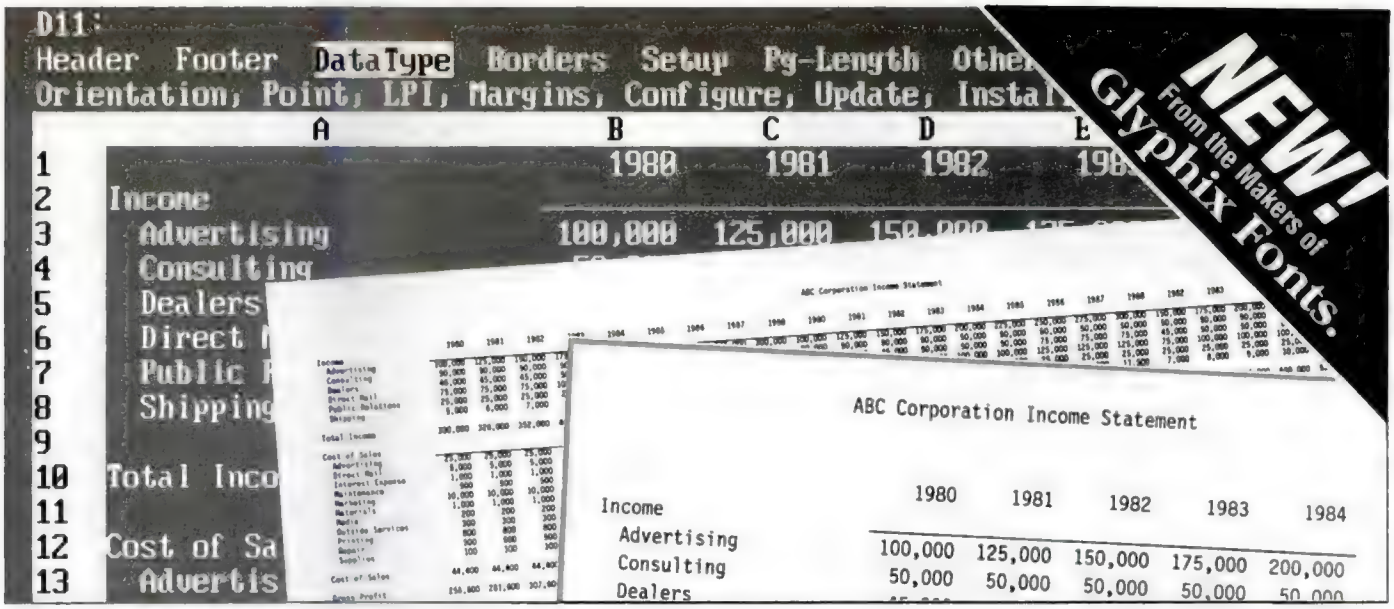
All in all, the package seems more than worth its price. If you often find yourself agonizing over data file conversions, give it a try. PC

PC MAGAZINE FACT FILE

***Data Junction*, Version 2.1**
Tools & Techniques Inc.
1620 W. 12th St.
Austin, TX 78703
(512) 482-0824
(800) 444-1945
List Price: $195
Requires: 512K RAM (640K RAM recommended), two disk drives (hard disk recommended), DOS 2.0 or later.
In Short: A hub-and-spoke system for database file conversion, equipped with an intelligent front end for entering, editing, and filtering data. Not copy protected.

CIRCLE 440 ON READER SERVICE CARD

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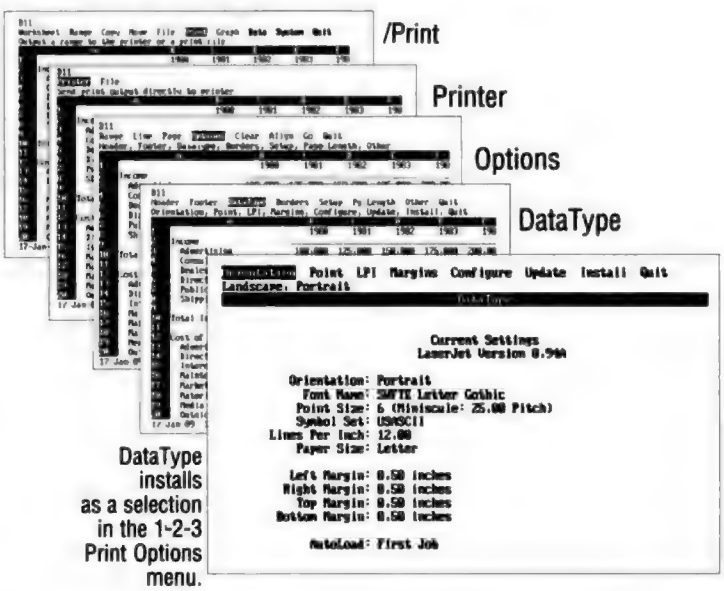


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DataType installs as a selection in the 1-2-3 Print Options menu.

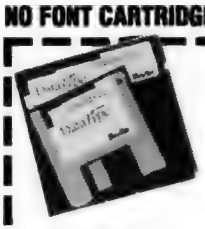
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SYSTEM REQUIREMENTS IBM PC, AT, XT, PS/2 or compatible, a hard drive, LaserJet Plus, Series II or compatible printer. MS-DOS 2.0 or later, 1-2-3 Version 2.0 or later. Lotus and 1-2-3 are registered trademarks of Lotus Development Corporation. SIDEWAYS is a trademark of Funk Software. © 1989 SWFTE International, Ltd.
† DataType is licensed one per printer. Multiple users may use DataType on a single shared printer.

CIRCLE 299 ON READER SERVICE CARD

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$1,695 CompuAdd 286-20: Yet Another Voice Enters the 286 vs. 386 Debate

PC HANDS ON

BY JONATHAN MATZKIN

The CompuAdd 286-20 PC, like all 20-MHz 286 machines, presents a dilemma to the potential buyer. The machine's performance is almost beyond criticism—it has speed and power to spare. But it's a 286-based machine in a world turning to newer 80386 technology. And in its basic configuration, the $1,695 system is only $200 cheaper than CompuAdd's 16-MHz 80386 machine.

A look at the results of the PC Labs benchmark tests dispels any doubts about how this well-built box performs. On the processor speed tests, the CompuAdd 286-20 screams along at two to three times the speed of an old standard 8-MHz IBM PC AT. Results from the 80286 Instruction Mix test were particularly impressive; by this measure, the 20-MHz system is fully three times faster than the original AT.

Add a fast disk to a machine with this kind of raw power, and you've got something to reckon with.

Our evaluation unit came with a monster 320MB drive that clocked in at 14.66 milliseconds on our hard disk BIOS Disk Seek benchmark test. Equipped with this big disk and VGA graphics, the system costs $4,949—including an authentic Harris 20-MHz 286 chip.



The CompuAdd 286-20 is a solid, fast performer. The $4,949 system we tested—with VGA graphics and a 320MB drive—was a power user's picnic.

One anomalous result did turn up when we tested the machine's extended-memory read-and-write times. It turned in a relatively sluggish performance—actually slower than a standard AT. That may be the result of slow switching in and out of protected mode by the Award BIOS. In any case, this can be largely overcome by shadowing the system and video BIOS into RAM.

The Award BIOS has the familiar Ctrl-Alt-Esc key sequence for BIOS configuration. I was annoyed to discover, however, that you can invoke the configuration screen only during a short period at boot-up. Miss your cue and you have to reboot.

While testing the machine, I took advantage of an optional megabyte of extended memory by installing *DESQview* and configuring the software to swap applications to a VDISK RAMdisk in extended memory.

Set up in this way, the CompuAdd 286-20 is a power user's picnic. Full-sized applications are swapped almost instantaneously, allowing rapid context switching between word processors, spreadsheets, and whatever else you are working with. We tried *XyWrite*, *Lotus 1-2-3*, *Tornado*, and several other applications, all of which ran fine. Microsoft's *Flight Simulator* also took off without delay.

If what you want is a fire-breathing DOS machine, the CompuAdd 286-20 is a good choice. But you give up access to 80386-based software, and that's something to think about. PC

PC MAGAZINE FACT FILE

CompuAdd 286-20
CompuAdd Corp.
12303 Technology Blvd.
Austin, TX 78727
(800) 666-1872
List Price: $1,695 (with 1MB RAM, one floppy disk drive, two serial ports, one parallel port, hard disk controller).
In Short: A well-built 20-MHz 286 machine from a well-established mail-order house.

CIRCLE 442 ON READER SERVICE CARD

PC LABS

Benchmark Tests: CompuAdd 286-20 vs. 8-MHz IBM PC AT and Compaq Deskpro 386/20

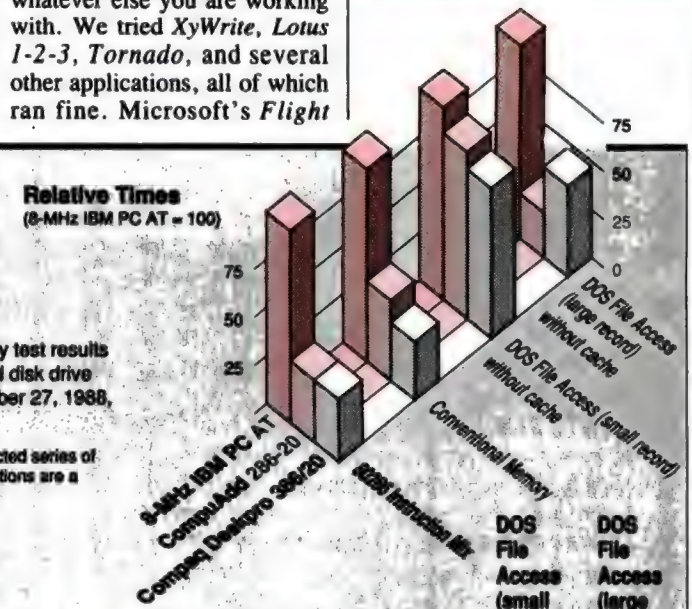
The CompuAdd 286-20's 80286 Instruction Mix and Conventional Memory test results are on a par with other 20-MHz 286 machines, but a 14-millisecond hard disk drive makes its DOS File Access times stand out from the crowd. (See the December 27, 1988, issue for benchmark tests of 20-MHz ATs.)

The 80286 Instruction Mix benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80286 instruction code. These instructions are a subset of the total processor instruction set.

The Conventional Memory benchmark test allocates 256K of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The DOS File Access benchmark test measures the throughput rate of the disk being tested. In this case, throughput times are measured in terms of how long the disk takes to perform common DOS file-management functions. Five tasks—file creation, sequential file write, sequential file read, random file write, and random file read—are timed and the results summed.

The test is carried out for two different types of files—small-record files and large-record files—that are used by common PC applications. Files created using small records are typically used by database management programs, and large records are typically used for word processing and spreadsheet files. Loading a DOS program is also simulated by the large-record test.



Performance Times (Times given in seconds)	80286 Instruction Mix	Conventional Memory	DOS File Access (small record) without cache	DOS File Access (large record) without cache
8-MHz IBM PC AT	8.96	1.32	72.63	19.74
CompuAdd 286-20	2.91	0.55	63.10	4.66
Compaq Deskpro 386/20	2.91	0.40	56.78	9.34

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C>ERASE *.*
Are you sure (Y/N)?_

« Data Guardian »

New Disk Optimizer® gives you the courage to say yes!

Introducing Disk Optimizer 4.0. Now with Data Guardian™ and Undelete.

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Enter new Disk Optimizer 4.0 with Data Guardian. The only disk utility software that lets you blithely say "yes" now, and if you want, change your mind later. Because only Data Guardian ensures that anyone can *Undelete* files, directories, even entire disks. And do it hours, days, up to weeks later, no matter what else you've written to your disk in the meantime.

Best of all, Data Guardian makes file recovery quick, easy and totally foolproof. Without the complexity of other data recovery software. And without the uncertainty. Thanks to Data Guardian, Disk Optimizer comes through for you every time.

You formatted what drive?

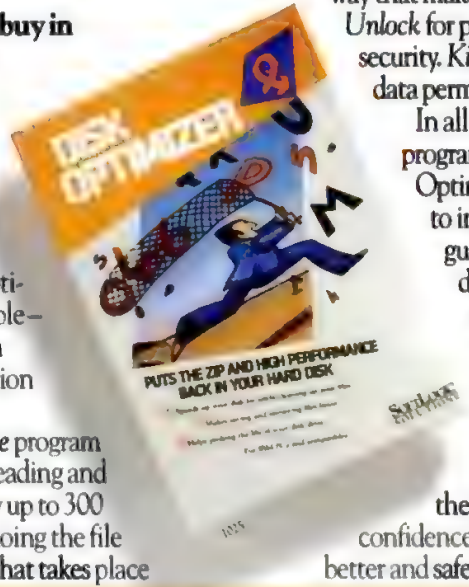
That's fine for erased files, you say. But what happens if you accidentally format your hard disk? No problem. Disk Optimizer comes through again with *UnFormat* that can instantly restore all the data on your disk to exactly where it was before that little slip of the finger on the keyboard.

And to make sure your data is really safe, the *TrackSaver* feature protects the surface of your disk from excessive wear by preventing the head on your drive from spinning over the same track for too long. And the *Refresh* program prevents the bad spots that develop on disks due to fading magnetic charges.

Still the safest buy in performance optimizers.

As always, Disk Optimizer also gives you the safest, most advanced performance optimization available—proven by over a quarter of a million users.

The *Optimize* program speeds up disk reading and writing times by up to 300 percent by un-doing the file fragmentation that takes place naturally over time. The *DOConfig* program lets you arrange the layout of your disk for best overall performance. And the *Analyze* program gives you a graphical look at the condition of your disk, so you'll always know when it's time to optimize again.



A total of 17 different programs.

Disk Optimizer includes *Findfile* for locating files by name or wildcard anywhere on your disk. *Sorts* for rearranging files and directories in the way that makes sense to you. *Lock* and *Unlock* for password-protected file security. *Killfile* for erasing sensitive data permanently. And lots more.

In all, there are 17 different programs in the new Disk Optimizer. Each one designed to improve performance, guard your data, and make disk management easier and simpler for everyone.

So get new Disk Optimizer 4.0, and get more than the courage to say yes. Get the peace of mind and total confidence that your disk is running better and safer all the time.

Disk Optimizer $69.95

Available at software dealers everywhere. Or, order direct by calling toll-free.

Call 800-272-9900
(603-627-9900 in NH)

SoftLogic Solutions, Inc.
One Perimeter Road, Manchester, NH 03103.

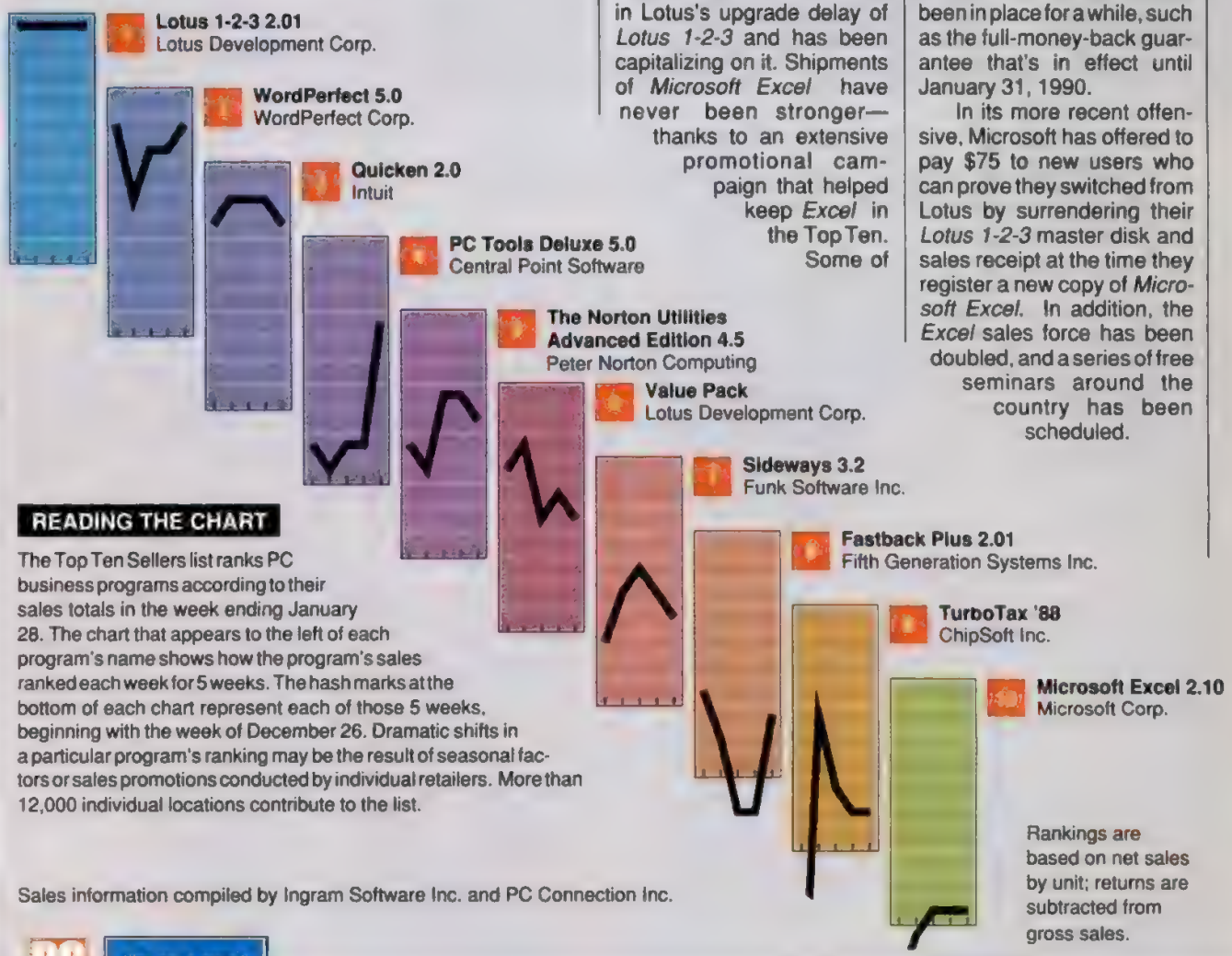
SOFTLOGIC SOLUTIONS

CIRCLE 334 ON READER SERVICE CARD

#6

PC MAGAZINE PIPELINE

TOP TEN SELLERS — A 5-Week History



Microsoft senses weakness in Lotus's upgrade delay of *Lotus 1-2-3* and has been capitalizing on it. Shipments of *Microsoft Excel* have never been stronger—thanks to an extensive promotional campaign that helped keep *Excel* in the Top Ten. Some of the current incentives have been in place for a while, such as the full-money-back guarantee that's in effect until January 31, 1990.

In its more recent offensive, Microsoft has offered to pay $75 to new users who can prove they switched from Lotus by surrendering their *Lotus 1-2-3* master disk and sales receipt at the time they register a new copy of *Microsoft Excel*. In addition, the *Excel* sales force has been doubled, and a series of free seminars around the country has been scheduled.

READING THE CHART

The Top Ten Sellers list ranks PC business programs according to their sales totals in the week ending January 28. The chart that appears to the left of each program's name shows how the program's sales ranked each week for 5 weeks. The hash marks at the bottom of each chart represent each of those 5 weeks, beginning with the week of December 26. Dramatic shifts in a particular program's ranking may be the result of seasonal factors or sales promotions conducted by individual retailers. More than 12,000 individual locations contribute to the list.

Sales information compiled by Ingram Software Inc. and PC Connection Inc.

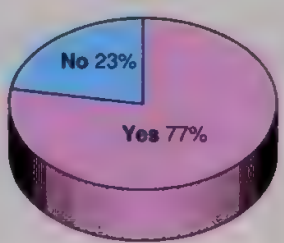
Rankings are based on net sales by unit; returns are subtracted from gross sales.

PC SURVEY

The last time we asked PC MagNet callers about desktop publishing, we left out graphics software. This time, we looked at the two together and found that the combination made many people go even further, thinking about their expectations for word processors that have extensive page layout features, like *WordPerfect* and *Microsoft Word*. Samna's brand-new word processor, *Ami*, made a few respondents' lists in the "other" category, although it didn't garner enough of the 900 responses to generate 1 percent.

The results bode well for both Aldus and Xerox, with their high-end desktop publishing programs. IBM, which is selling its *Interleaf Publisher* for 386 PCs only, didn't fare as well.

Do you or your company plan to purchase desktop publishing or graphics software within the next 12 months?



386SX CHIPS HEADING FOR THE SPOTLIGHT

Ever since Compaq unveiled the first 386 PC in September 1986, the trend among PC buyers has been a slowly but steadily growing preference for the more powerful of Intel's line of microprocessors. You might think Intel would want to do everything it could to help accelerate the trend. Yet Intel is now doing its best to divert the momentum away from its top-of-the-line 386.

No, Intel won't be enhancing the 8088 or 286. It's dropping the price on the 386SX (the 16-bit I/O version of the 386 that it introduced last year) in order to gain more market share for the chip. In February, Intel cut the cost of 16-MHz 386SX chips in half (from about $165 each to roughly $90 for bulk orders). And it's bringing two brand-new factories on-line to stamp out more chips.

Intel is hoping to highlight the greatest advantage of the 386SX—delivery of 386 features at lower cost—in order to steal some of the thunder that Harris has built up with its fast CMOS 286 chips.

Intel has had fabulous success with processors, but the SX has taken off faster than either the 286 or 386. In its first 6 months on sale, five times more SX chips were shipped than 386s in that processor's first 6 months. The SX also beat the 286 by a ten-to-one margin for the comparable launch period.

The SX price cut has some risk for Intel, since the company is often caught at the wrong end of a supply-demand curve. A year ago, Intel couldn't keep up with the strong demand for 386 chips, but now there's a glut. However, Intel sees the real threat to its leadership role coming from the fast 286s. Since 386 machines, with their RAM caches and fast hard disks, tend to sell for significantly higher prices than 286 PCs and therefore don't appeal to everybody, Intel is trying to maintain dominance in both the high-end and the middle range. It's now holding on to about 65 percent of the 286 processor market and a significantly lower share of the 8-bit 8088 shipments.

The value of Intel's 8088 processor was significantly reduced in February when a federal judge ruled that NEC could continue selling its competitive V series. The judge found that Intel had forfeited its copyrights on the 8086/88 by allowing licensed third parties to distribute chips without proper copyright notices.

Intel would like nothing better than to see the 286 become the low-end PC processor while the 386SX supplies the middle range. The company still refuses to license production rights to either of its 32-bit chips, and since it now seems fully able to supply all the demand on its own, it's unlikely that that will change.

> Intel would like nothing better than to see the 286 become the low-end PC processor.

Right now, Intel seems more interested in forcing the second-source producers of the 286 and 8088 into oblivion.

Businessland Sees PC Rentals Growing

PC rentals have been a limited phenomenon. Unlike earlier computer equipment, PCs are so cheap that rented machines have been necessary only in special circumstances like setting up a temporary location or when dealing with an unpredicted project.

Businessland thinks rentals are poised to take off. Citing the tendency of many companies to rent top-of-the-line PCs as a way of testing new technology or to fill in for machines in the shop, the chain is planning to open Businessland Rents centers in 20 cities over the next few years.

With so many choices in adapters, disk drives, and printers, there's now more of a motivation to try expensive setups before buying.

Signposts

Many of the stories on hardware and software vendors in the financial papers of late have been reports of layoffs and plant closings. It might lead you to believe that there'll be fewer products coming to market. Unlikely.

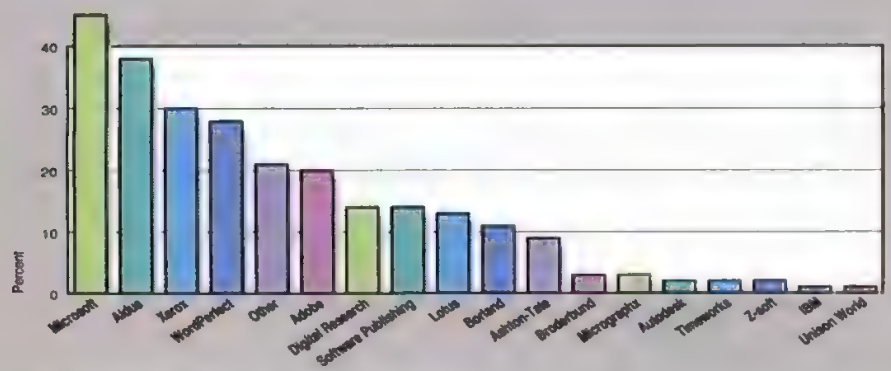
Western Digital has eliminated 400 jobs, reducing its workforce by 12 percent in recent months; but those savings are a result of automating assembly, and the company's revenue continues to rise. AST laid off about 6 percent of its entire staff, but it's scaling back an effort to sell DEC hardware and will concentrate on its core PC products instead.

Leading Edge, on the other hand, is suffering badly. It had to lay off its entire sales force and entertain takeover bids. It's rumored that a supply of bad parts was the last trauma in a series of bad management decisions. The brand will probably be kept on the market with new management.

At the same time, others have been expanding. Macola is doubling its staff and office space; WordPerfect Corp. has just finished doubling its personnel (including a doubling of the telephone support crew to 400); and Dell Computer is tripling its capacity in 1989.

—Gus Venditto

From which of the following companies will you or your company purchase desktop publishing and/or graphics software within the next 12 months?



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Finally...The First Bus-Mastering Hard Disk Controller for the Micro Channel

PC HANDS-ON

BY WINN L. ROSCH

Sometimes revolutions tiptoe in so quietly you might not notice the radical changes they bring until they've slipped into your life. Core International's new MCA hard disk subsystem, a combination of the company's $6,495 HC-380 hard disk and $595 CNT-MCA disk controller, is a case in point. You may be tempted to buy this pairing for your PS/2 Model 60 or 80 just because it's among the fastest mass-storage combinations around. In fact, as the first bus-master disk subsystem for the Micro Channel architecture, the pain ushers in a entirely new technology.

Put simply, a bus master can take over control of the expansion bus and directly access memory or other devices connected to it. While the bus master is in control, the host computer's microprocessor can do other things.

Although current software doesn't take much advantage of this ability, bus masters earn merit for another benefit. Even the best conventional bus technologies require at least two microprocessor cycles to move a byte from point A in memory to point B—one cycle to set up the transfer and one to make the actual data move. The bus master can make the memory move in half the time (one bus cycle). Potentially, the effective data throughput between disk and computer can double.

The Core system exploits both benefits of bus master technology. Novell-based systems can take advantage of the subsystem's ability to duplex hard disks, which uses some of the CNT-MCA's bus master power. Two Core disk drives connected to the controller can operate in tandem, capturing all disk writes at the same time and assuring that you will have a duplicate for backup should one disk fail. (Although the CNT-MCA controller will work with other drives, it supports duplexing only with Core drives.) At the same time, bus master speed gives the total system a performance edge over other hard disk options.

The HC-380 hard disk is based on a high-performance Control Data Corp. drive that features a DOS formatted capacity of 380MB (442MB unformatted). It delivers an average access time of 16 milliseconds and transfers data at 10 MHz, thanks to its ESDI interface.

The CNT-MCA controller is a 16-bit Micro Channel expansion card that follows the IBM standard to the letter. The current implementation supports one or two ESDI drives with data transfer rates of 10 MHz. An upgraded version to handle future 15-MHz ESDI drives is in the works.

Unlike the standard-equipment IBM hard disk controller, the CNT-MCA will coreside with other controllers, including both the IBM and a duplicate of itself. You can keep your stock IBM drive and add the HC-380/CNT-MCA system without a hassle.

In testing, performance proved the technology. As data blocks get larger, the Core system edges past twice the speed of the stock IBM system—more than could be hoped for from the upgrade to the ESDI interface alone. (System overhead and mechanical factors prevent doubling the throughput.)

In truth, the performance improvement alone may not be enough justification for this system. However, its support of Novell duplexing as well as multiple drives and controllers makes it an excellent choice for Micro Channel–based servers. Although the HC-380/CNT-MCA combination only hints at the potential of Micro Channel bus masters, its power and performance confirm that the revolution is under way. PC

PC MAGAZINE FACT FILE

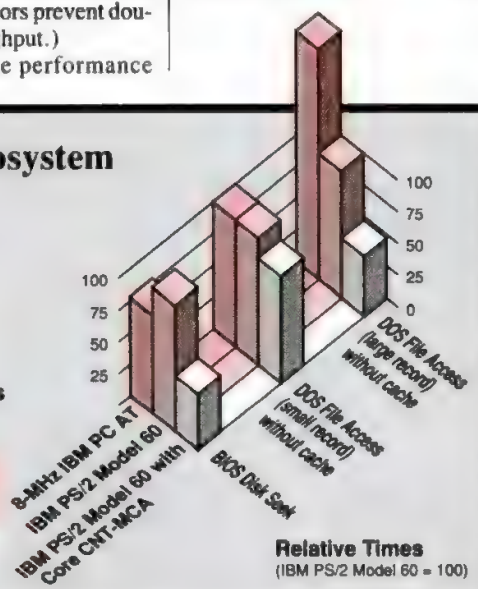
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In Short: A high-performance hard disk subsystem for Micro Channel PS/2s, featuring the first bus-mastering hard disk controller for the MCA. Supports Novell disk duplexing.

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PC LABS Benchmark Tests: Core CNT-MCA Disk Subsystem vs. Stock IBM PS/2 Model 60 Subsystem

The Core CNT-MCA provides substantial improvement over the IBM PS/2 Model 60's standard controller, though the favorable test results are mainly a result of the faster mechanical speed of the Core disk. The disk tests were not designed to reflect the performance gains of a bus-mastering controller.

Performance Times (Times given in seconds except where noted)	BIOS Disk Seek (milliseconds)	DOS File Access (small record) without cache	DOS File Access (large record) without cache
8-MHz IBM PC AT	29.20	72.63	19.74
IBM PS/2 Model 60	37.24	72.41	10.86
IBM PS/2 Model 60 with Core CNT-MCA	16.55	60.99	5.11



The **BIOS Disk Seek** benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

The **DOS File Access** benchmark test measures the throughput rate of the disk being tested. In this case, throughput times are measured in terms of how long the disk takes to perform common DOS file-management functions. Five tasks—file creation, sequential file write, sequential file read, random file write, and random file read—are timed and the results summed.

The test is carried out for two different types of files—small-record files and large-record files—that are used by common PC applications. Files created using small records are typically used by database management programs, and large records are typically used for word processing and spreadsheet files. Loading a DOS program is also simulated by the large-record test.

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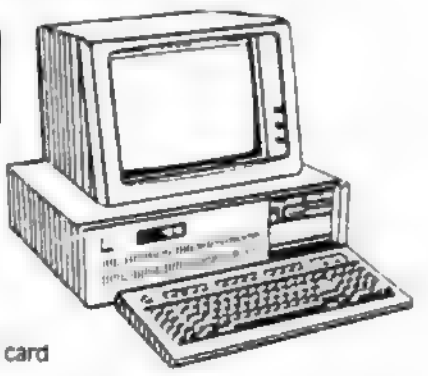
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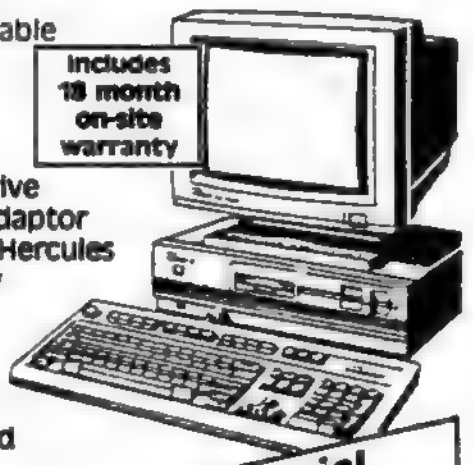
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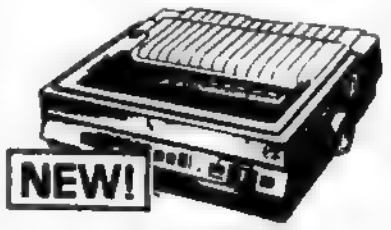


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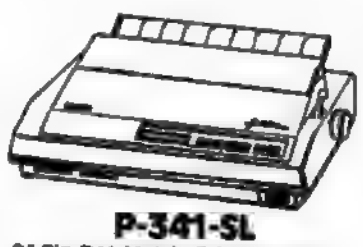


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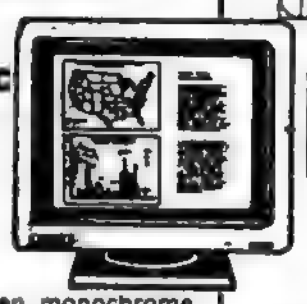


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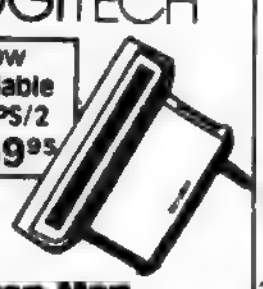


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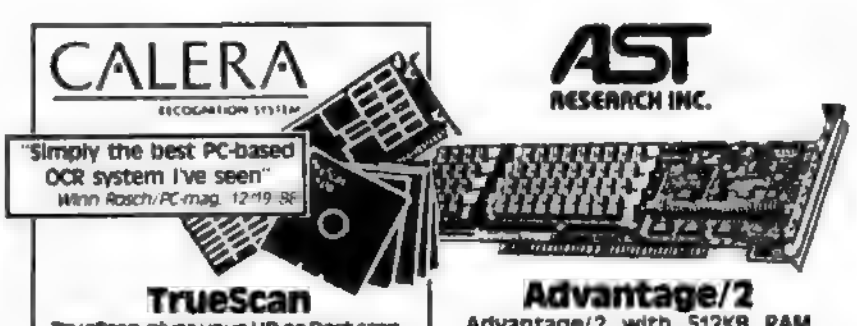
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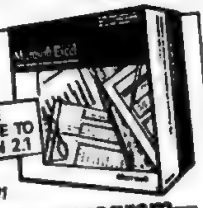


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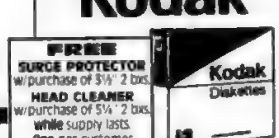
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Omniview: Aspiring Multitasker Falls Short

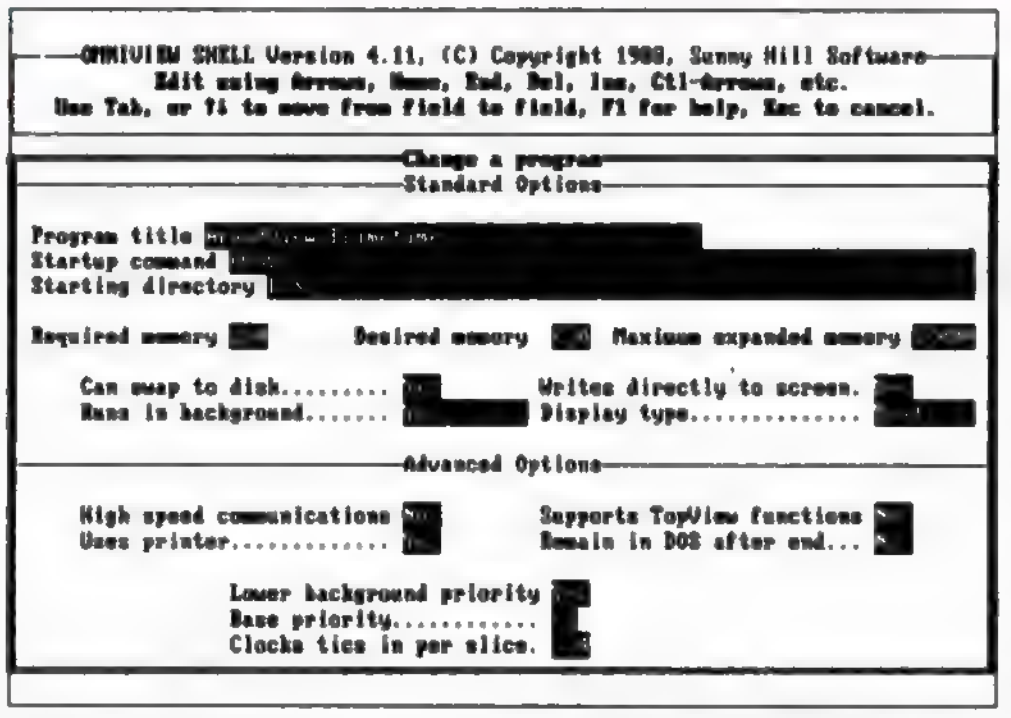
PC HANDS ON

BY BARRY SIMON

I've been hooked on the context switching you get with *Software Carousel* for some time: it allows you to keep as many as ten applications open at once and jump between them with just a touch of a key. But of late I've yearned to go beyond *Carousel*'s switching to true multitasking.

I've tried several multitasking environments, but I found them too intrusive and/or too incompatible with the programs I like to run. So I was excited by Sunny Hill Software's *Omniview*, a new multitasker whose basic philosophy is closer to my taste. Alas, it still has too many serious problems to become a permanent fixture on my system yet.

The basic idea of *Omniview* is to multitask only on a full-screen basis. While I'm a fan of *Microsoft Windows*, I've no interest in running applications in a window when they think that they have the whole screen, so I regard the full-screen orientation of *Omniview* as a virtue.



Each Omniview partition has its own start-up card, which you fill out to determine memory use and various advanced options.

Omniview is quite easy to set up. Like *Carousel*, you set up individual partitions that you can toggle between once you're up and running. For each partition, you can specify whether it should run in the background and whether it can swap to disk, as well as a few other parameters. The set of options is less extensive than that of *DESQview* but more complicated than that of a pure context switcher like *Carousel*.

In the menu mode, there is a simple form to fill out for each application. The manual comes with forms filled out for 40 popular applications.

A number of software tools are provided to enable you to write powerful batch files. For example, you could spawn a new partition to copy a file in the background while the foreground batch file continues.

To multitask in more than 640K, you'll need an EEMS board or LIM 4.0 memory explicitly able to swap memory below the 640K boundary. With an 80386-based computer, *386-to-the-Max* or *QEMM-386* will give you this LIM 4.0 capability. *386-to-the-Max* provides specific support for *Omniview* that will also give you virtual screens to prevent one application from bleeding through to another.

All in all, the product seems well planned. Unfortunately, it doesn't work very well. During the past few months, I've seen several released and intermediate versions of this product, and each one has had serious problems. I have not yet been able to run *SideKick Plus* under *Omniview* on my system—an IBM PC AT with an Intel Inboard and Genoa EGA. On most versions, including the latest, I've been unable to successfully run a communications program in the background. On the current edition (Version 4.11), running DOS's mono mode on a two-monitor system crashed the computer.

This product bears watching. But at least for now, if you require multitasking, look elsewhere. PC

Pizazz Plus Captures Images to DTP Formats, Converts Color to Gray Scale

PC HANDS ON

BY JONATHAN MATZKIN

When *PC Magazine* first reviewed *Pizazz*, we described it as a "turbo-charger" for your PrtSc key, because it added a whole range of image-manipulation possibilities to DOS's lowly screen-dump facility. The memory-resident utility pops up over most any text or graphics screen and allows you to capture and manipulate the image. *Pizazz Plus*, as it is appropriately called, looks much like its predecessor but adds a laundry list of new features.

To begin with, *Pizazz Plus* supports a much wider range of graphics standards, including VGA. There is also support for some of the high-end image-capture systems, like AT&T's Targa board. Improved dithering and screen analysis allow *Pizazz Plus* to specify a total of 16 million possible colors on color output devices or up to 256 shades of gray on monochrome printers. The package now supports a total of 220 printers. Of course, results vary according to the capabilities of a particular output device.

The package also effectively translates color images into gray scales. Results aren't of photographic quality, but *Pizazz Plus* puts out good-looking halftones on an HP LaserJet Series II.

Another major enhancement allows you to save a captured screen image in a variety of formats. *Pizazz Plus* stores images that will print in supported applications, such as *Ventura Publisher*, *Microsoft Word*, and *WordPerfect*, exactly as they are printed by *Pizazz Plus*. So a user can fuss with an image until it is ready, store it, and then print it out in the appropriate application. There are also two formats, for *Publisher's Paintbrush* and Spinnaker Software's *Splash*, that store screen-based images rather than printer image files.

Pizazz Plus builds rather nicely on the success of its useful predecessor. It helps simplify the inclusion of graphics images in desktop publishing projects. PC

List Price: *Pizazz Plus*, $149; upgrade from *Pizazz*, $59.
Requires: 32K free RAM, graphics adapter, DOS 2.0 or later. Not copy protected. Application Techniques Inc., 10 Lomar Park Dr., Pepperell, MA 01463; (508) 433-5201.

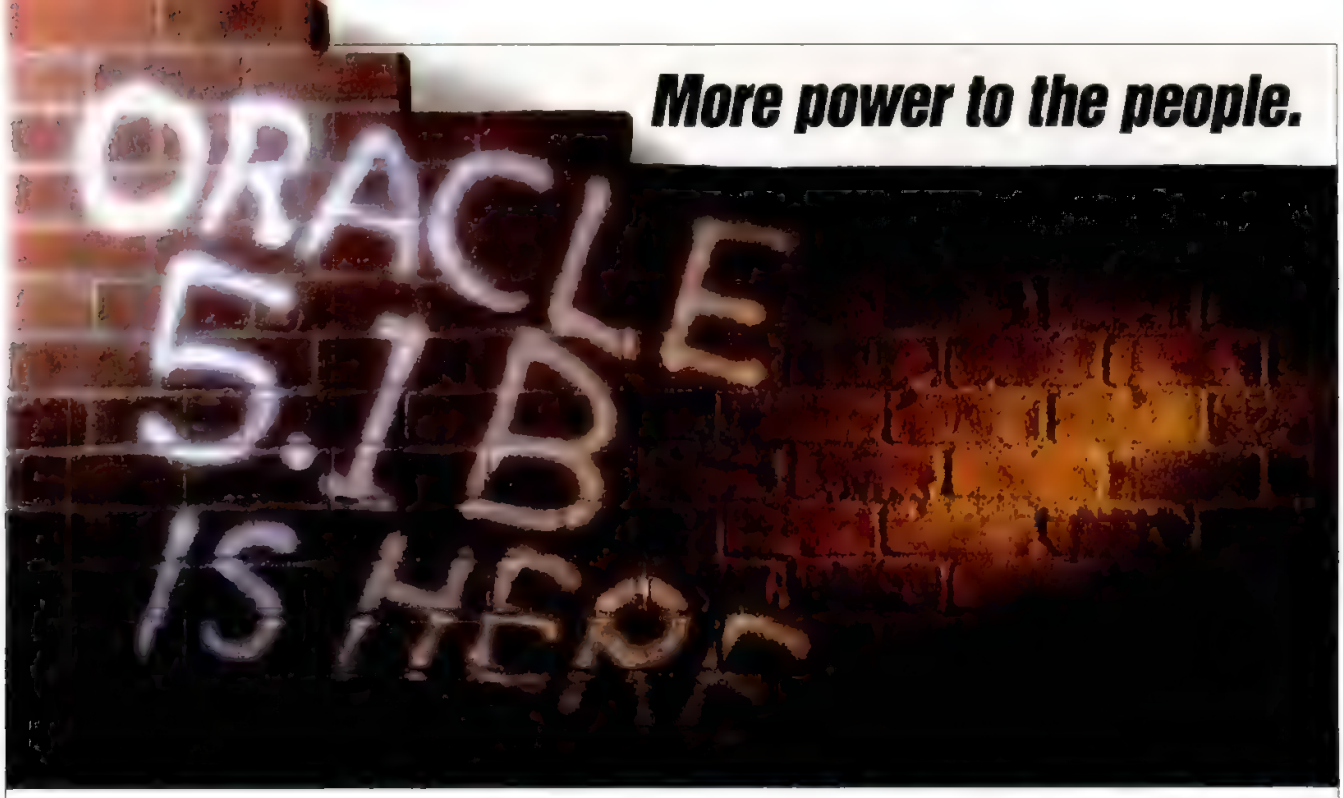
CIRCLE 456 ON READER SERVICE CARD

PC MAGAZINE FACT FILE

***Omniview*, Version 4.11**
Sunny Hill Software
P.O. Box 55278
Seattle, WA 98155-5278
(206) 367-0650
List Price: $89.95
Requires: 256K RAM, DOS 2.0 or later. Not copy protected.

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PC MAGAZINE EDITORS' CHOICE May 17, 1988

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$79 PC Tools Deluxe Adds Format Recovery, Disk Defragmenter, Desktop Accessories

PC HANDS ON

BY EDWARD MENDELSON

Older versions of *PC Tools Deluxe* resembled a Swiss Army knife. The redesigned edition—Version 5—resembles a combination hardware store, stationery supplier, and gadget catalog.

The foundation of Central Point Software's $79 package is a traditional ensemble of disk and file utilities, now incorporated into a mouse- or keyboard-driven DOS shell that can run applications as quickly as it recovers deleted files. CPS adds a backup program, a disk defragmenter, a format recovery program, and a custom version of the *Super PC-Kwik* disk cache that earned Editor's Choice in the recent *PC Magazine* cache roundup (February 14, 1989).



PC Tools Deluxe, *Version 5, adds an impressive collection of desktop utilities, including a word processor with spelling checker and a database.*

To all this, the new version adds an elaborate Desktop program, modeled loosely on the *Microsoft Windows* and Macintosh desktops.

The Desktop includes a miniature word processor with spelling checker, which can open 15 files at once; three calculators, including an elaborate financial one; a flexible scheduler; a simple database; an even simpler outliner; and a rudimentary telecommunications program that can transfer files in the background via Xmodem.

You can run *ProKey*-compatible keyboard macros that will work in the Desktop alone and also in your applications, and you can use a clipboard to transfer data from any application to another. Add to all this a file encryption program, and you'll understand why the manual fills 500 pages, not counting a 24-page addendum and a last-minute README file.

Both Desktop and shell can be run as resident or nonresident programs. As a TSR, the shell swallows as little as 9K of DOS memory while stowing the rest of its code in EMS. The Desktop needs a mere 38K to manage all its features and let you pop them up over any application. No other program offers so much in so little RAM.

The closest rival to the *PC Tools Deluxe* shell is *The Norton Utilities*, which doesn't include a backup or cache but includes more efficient and intuitive tools for editing and managing a disk. The file editor in the *PC Tools* shell, for example, doesn't let you search for data in the file; *Norton*'s makes the search effortless. But if *PC Tools* can't excel *Norton*, it generally equals it. Both packages' safe-format programs can sometimes extract data from otherwise unreadable disks. Both undeleters include options that virtually guarantee successful recovery of lost files. Both defragmenters now offer a full range of choices for rearranging the contents of your disk.

But *Norton* has nothing to compare to the *PC Tools Deluxe* Desktop, which falls between Borland's *SideKick* and Lotus's *Metro* in power and flexibility and is generally easier to use than both.

PC Tools' shiny new interface uses pull-down menus, dialog boxes, and resizable, movable windows, plus modern conveniences such as an automatically saved configuration that opens each window at the location where you left it yesterday. If you use a mouse, the new interface is more efficient and elegant than the utilitarian interface familiar from earlier versions. But you may find you need to press a few more keys if you insist on keeping your fingers on the keyboard.

The disk and file utilities stored under the shell rank among the very best. The safe-format program can sometimes extract data from otherwise-unreadable disks. The undeleter includes options that virtually guarantee successful recovery of lost files. The defragmenter now offers a full range of choices for rearranging the contents of your disk.

Backup Problems

The most problematic element of the package is the backup program, which requires too many unintuitive keystrokes for initial configuration and is fussy about the exact moment when you must insert the first disk. Although the *PC Tools* cache is a subset of *Super PC-Kwik*, the backup program doesn't coexist with the *Super PC-Kwik* version, and the combination produces error messages that can terrify you into thinking your backup disks are no good when in fact the data is intact.

The file encryption program uses the DES method, which is so powerful that this part of the program cannot legally be exported from the United States. But don't assume that your encrypted files are therefore secure from determined snoopers. The original form of the data remains intact on your disk and can be retrieved effortlessly with any undelete or disk-search program—including the ones conveniently included in *PC Tools Deluxe*. The encryption program would certainly be a lot more useful if it wiped out the original data by overwriting its sectors.

PC Tools Deluxe performs many functions impressively well, but you can get dedicated programs that perform most of its functions better. Your choice is between paying $79 for the cornucopia of *PC Tools Deluxe* or hundreds of dollars for separate packages. *PC Tools* is without a doubt a good place to start, but you may not want to stay there.

FACT FILE

***PC Tools Deluxe*, Version 5**
Central Point Software
15220 NW Greenbriar Pkwy., #200
Beaverton, OR 97006
(503) 690-8090
List Price: $79
Requires: 512K RAM (hard disk and 320K EMS recommended), DOS 2.0 or later.
In Short: Every imaginable file utility and desktop accessory in one mouse-driven or keyboard-driven package. Not copy protected.

CIRCLE 455 ON READER SERVICE CARD

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PC MAGAZINE **EDITOR'S CHOICE** September 1987

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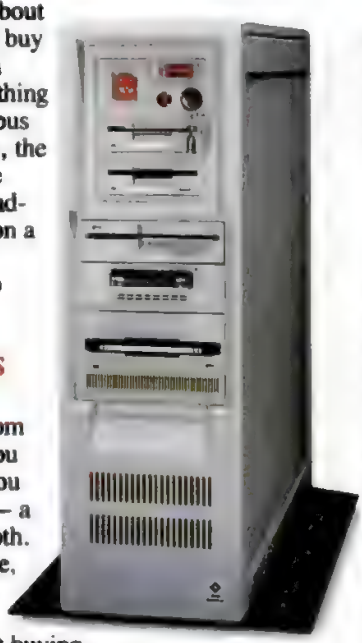
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Ask any computer expert about what type of system you should buy nowadays and you'll likely get a "pass the bus" response. Something like — "Well, uh, the PC/AT* bus is your best buy but, then again, the new PS/2* bus may become the next industry standard." Great advice, right? If trying to decide on a microprocessor weren't tough enough, now you're expected to pick a bus, too.

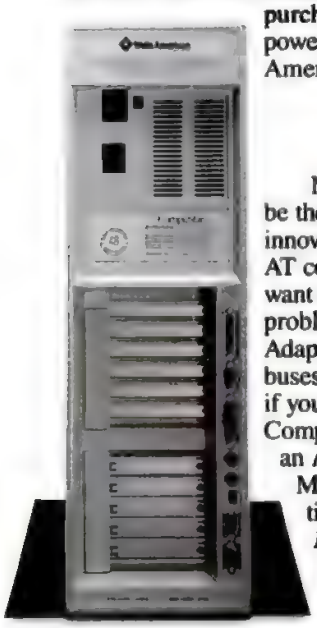


RELAX, NOW THERE'S COMPUSTAR®.

The all new CompuStar from Wells American not only lets you interchange microprocessors, you can also mix and match buses — a PC/AT bus, a PS/2 bus or. . .both. As your computing needs change, simply snap in a new processor or add an extra bus. You'll never again have to worry about buying the *wrong* computer system!

FOUR COMPLETE SYSTEMS IN ONE.

The CompuStar can be configured with any of four microprocessors — an 8086, an 80286, an 80386SX, or an 80386. The processor and up to *16* megabytes of user memory have all been combined, using the latest VLSI technology, on a single, plug-in CPU module. Plus, any time during the first year of ownership, CompuStar users can "trade-in" the CPU module they initially selected toward the purchase of any of the other more powerful modules. *Nobody* but Wells American gives you this kind of value.



A CONVERTIBLE BUS? YOU'RE KIDDING!

No, we're not. In fact, it may well be the most practical microcomputer innovation ever. Say you've selected an AT compatible CompuStar and later want to add PS/2 compatibility. No problem! Snap in a PS/2 Bus and Adapter Module and you can use *both* buses in the same system. Likewise, if you've selected a PS/2 compatible CompuStar and decide you want to add an AT bus, just snap in an AT Bus Module. Depending on configuration, the CompuStar can have up to *13* bus expansion slots — all AT slots, all PS/2 slots or a "split-bus" of AT *and* PS/2 slots. No matter which bus becomes the next industry "standard," you'll have peace of mind knowing your investment in a CompuStar will be protected.

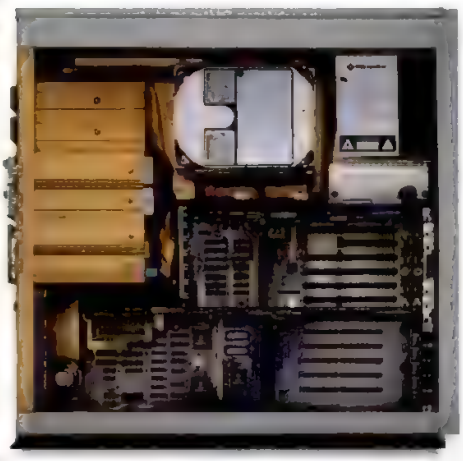
The CompuStar is also easily expanded. That's because there are *seven* CompuStar disk/tape compartments — six accessible from the front and an additional full-height bay inside. All this in a sleek, compact tower design that will leave *more* room on your desktop than any of the so-called "desktop" models.

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Think all this technology sounds expensive? It's not. CompuStar 20MHz 80286 systems start as low as $1995†. There are also inexpensive 8086 and powerhouse 25MHz 80386 systems available. Plus, there is a wide variety of CompuStar display, tape and disk options including a one gigabyte erasable optical disk. You can choose a factory pre-configured CompuStar or custom design one yourself. Just unlock the front panel and literally "snap-in" a bus, CPU, memory or disk module in a matter of seconds. It's system flexibility never before available. . .at *any* price.



While one of our competitors (we won't mention any names) threatens you with "missing the bus," most simply *pass* the bus. Our new CompuStar, however, *eliminates* the bus problem altogether. Not to mention the processor problem. Even the expansion problem. Prove it to yourself. Call today about our 31-day trial offer. Oh, and by the way, the next time anyone asks, tell 'em you know where the bus stops.

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*Personal Computer AT, AT and PS/2 are trademarks of International Business Machines Corporation. †Photographs depict optional equipment. A complete price list is available upon request. CompuStar 80286 system ($1995) includes an AT Bus Module, built-in VGA/EGA display adapter, one diskette drive with controller, two serial/one parallel/one mouse port, keyboard and 220 watt power supply.

CIRCLE 513 ON READER SERVICE CARD

NEW ON THE MARKET

by Lori Grunin



The 8-page-per-minute NEC Silentwriter LC 890XL features two 250-page sheet feeders.

NEC Silentwriter LC 890XL PostScript Printer

The latest PostScript printer to pop off **NEC**'s production line, the $6,995 NEC Silentwriter LC 890XL, features Adobe's 68020-based Atlas controller, 4MB RAM (expandable to 8MB RAM for an additional $2,395), and an optional 20MB hard disk drive.

Primarily designed for use in multiuser and graphics-intensive environments, the printer's optional $999 drive and new controller offer up to three times faster throughput over the company's previous model, as well as the ability to store large numbers of fonts and overlays, according to NEC.

The 8-page-per-minute printer comes with 35 resident typefaces and emulates both the HP LaserJet Series II and the Diablo 630 ECS.

List Price: NEC Silentwriter LC 890XL, $6,995; 20MB disk drive, $999; additional RAM, $2,395. NEC Information Systems Inc., 1414 Massachusetts Ave., Boxborough, MA 01719; (508) 264-8000, (800) 632-4636.

CIRCLE **448** ON READER SERVICE CARD

Step IVward Converts Database Application Code to dBASE IV

To ease the transition from *Clipper*, *FoxBASE*, and *Quicksilver* to *dBASE IV*, **Ashton-Tate** is offering *Step IVward*, a program to translate the source code from applications of those database products into executable *dBASE IV* code.

The menu-driven utility preserves functions such as file-tree processing, in-code commenting, and full printing capabilities.

List Price: *Step IVward*, $89.95. **Requires:** 640K RAM, DOS 3.1 or later. Not copy protected. Ashton-Tate, 20101 Hamilton Ave., Torrance, CA 90502; (213) 329-8000, (800) 437-4329.

CIRCLE **451** ON READER SERVICE CARD

LazaGRAM Outputs 300 By 1,500 Dpi on Your HP LaserJet

The LazaGRAM, a $695 laser beam modulator card from **FX Unlimited,** breaks the 300-dot-per-inch resolution barrier of laser printers, providing 300 by 1,500 dpi. This enables users to output 100-line-screen, 64-shade gray-scale images, according to FX Unlimited.

The card fits into the I/O slot of any Canon-based laser printer equipped with Tall Tree Systems' JLaser printer controller. LazaGRAM quintuples the number of dpi by manipulating the electrical charges sent to the printer drum, which alters the amount of toner used to generate each dot.

The LazaGRAM supports *Ventura Publisher*, *PageMaker*, and *3B2*.

List Price: LazaGRAM, $695. **Requires:** Tall Tree Systems' JLaser printer controller, Canon-based laser printer. FX Unlimited, 4151 Middlefield Rd., #110, Palo Alto, CA 94303; (415) 494-0888.

CIRCLE **447** ON READER SERVICE CARD

19-Inch Lundy 1612 Displays 1,600 by 1,200 Pixels

For $9,950, the **Lundy** 1612 color raster monitor gives demanding graphics users 1,600-

(continues on next page)

HOT PROSPECT

Hand-held Remote Keyboard Runs Your PC from 35 Feet

If you're tired of blocking your dynamite presentations with your body, perhaps it's time for you to move to the back of the room with **Presentation Electronics**' SilentPartner, a $495 hand-held, programmable remote keyboard.

The SilentPartner's receiver plugs into either the keyboard port or serial port of your PC, be it a desktop or a laptop. You program the keys of the remote using the menu-driven *SProgram* software, then download the information into the receiver. The remote, whose keys glow in the dark, can operate up to 35 feet from the receiver.

The remote keyboard has 23 keys; 20 of them are macro keys, and the remaining three let you toggle between three sets of macro definitions. A single macro can hold as many as 78 keystrokes. Typically, each set of definitions, or template, will drive one application, and you can create as many templates as you want and store them for future use.

List Price: SilentPartner, $495. **Requires:** *SProgram* software: 256K RAM, DOS 2.0 or later. Not copy protected. Presentation Electronics Inc., 3096 Wiese Way, Sacramento, CA 95833; (916) 646-3402.

CIRCLE **444** ON READER SERVICE CARD



The SilentPartner's hardware consists of an infrared remote control and a receiver that attaches to your PC.

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NEW ON THE MARKET

LUNDY 1612

(continued from page 51)

by 1,200-pixel resolution and an on-board 50-MHz TI34010 graphics coprocessor operating at 6 mips (million instructions per second).

Its standard 1MB of display list VRAM (expandable to 8MB) enables the monitor to display 16 colors out of a palette of 4,096 at maximum resolution, or 256 colors at an 8514/A-compatible resolution of 1,024 by 768.

Drivers for over 100 programs, including *AutoCAD*, *Microsoft Windows*, *Harvard Graphics*, *WordPerfect* 5.0, *Ventura Publisher*, and *PageMaker*, come with the display.

List Price: Lundy 1612 display, $9,950. **Requires:** 80286-based system. Lundy Electronics and Systems Inc., One Robert Ln., Glen Head, NY 11545; (516) 671-9000.

CIRCLE **450** ON READER SERVICE CARD

CrossView Helps Pinpoint Data Patterns

Are you going cross-eyed from poring over reams of printouts, all in the attempt to spot some meaningful relationships within your data? *CrossView*, a $2,000 software package from **DataEase International,** simplifies the process of data analysis by providing quick, on-screen, *n*-dimensional cross-tabulations and pattern identification.

Let's say you have data on the number of widgets your firm has sold in each state for the past 10 years, who sold how many, and the amount of revenue they generated. *CrossView* helps you target your best or worst salespeople by region and year, by designating each item as a column, row, page, or hyperpage. Changing the breakdown requires only a few keystrokes.

CrossView accepts data from *DataEase*, the company's database software, or in fixed-field ASCII format. Upon importing the data, the program stores only unique values, rather than entire records, thereby compacting the dataset.

List Price: *CrossView*, single-user version, $2,000; server pack (up to six users), $3,000; every three additional users, $1,000. **Requires:** 640K RAM, DOS 3.0 or later (hard disk and color monitor—CGA or better—recommended). Not copy protected. DataEase International Inc., 7 Cambridge Dr., Trumbull, CT 06611; (203) 374-8000, (800) 243-5123.

CIRCLE **445** ON READER SERVICE CARD



When creating tables with CrossView, *you can specify mathematical transformations to perform on a desired item.*

Dolch Puts 25-MHz 386 Power into 20-Pound Portable

It was only a matter of time before the 25-MHz 80386 chip found its way into a portable computer, and the time has finally arrived: the **Dolch** P.A.C. 386-25 now brings the power of that processor to a 20-pound luggable.

The $9,495 system, which sports the same 640 by 400 pixel Electroluminescent flat-panel display as the other Dolch P.A.C. luggable machines, comes with standard features such as a 19-millisecond 40MB hard disk, 4MB RAM, a 1.2MB floppy disk drive, an SCSI port, and six expansion slots.

List Price: Dolch P.A.C. 386-25, $9,495. Dolch Computer Systems, 2029 O'Toole Ave., San Jose, CA 95131; (408) 435-1881.

CIRCLE **449** ON READER SERVICE CARD



The Dolch P.A.C. 386-25's SCSI bus attains data transfer rates of up to 4 megabytes per second, according to Dolch.

Photograph: Thom O'Connor

Send-Off! WordPerfect and 1-2-3 Files from Your Connection CoProcessor

WordPerfect 5.0 and *Lotus 1-2-3* users who've installed **Intel**'s Connection CoProcessor in their machines can now harness that board's ability to perform background communications with Intel's *Send-Off!* software add-ins.

The *Send-Off!* add-ins enable users of these applications to transmit and receive faxes and files from within either application. *WordPerfect* graphics, charts, and formatting and binary-format *1-2-3* worksheets can be transferred in the background, thanks to the board's 10-MHz 80188 processor.

Send-Off! is free to registered Connection CoProcessor users. The *1-2-3* add-in will be sent automatically to all board owners and bundled with it in the future; *WordPerfect* 5.0 users, on the other hand, must request a copy of the software from Intel.

List Price: *Send-Off!* add-ins, free to registered users of Intel's Connection CoProcessor. *WordPerfect* 5.0 add-in available upon request. *Lotus 1-2-3* add-in will be sent automatically and provided with all new Connection CoProcessor boards. **Requires:** Intel's Connection CoProcessor, *Lotus 1-2-3* or *WordPerfect* 5.0. Not copy protected. Intel Corp., PCEO, CO3-7, 5200 NE Elam Young Pkwy., Hillsboro, OR 97124; (503) 629-7354, (800) 538-3373.

CIRCLE **446** ON READER SERVICE CARD

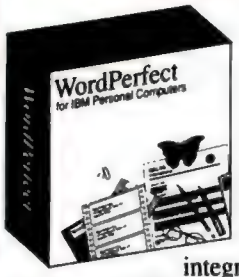
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SPECIALS

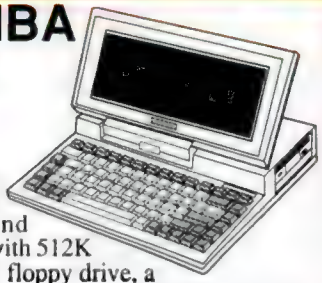
WordPerfect 5.0



$215
List $495

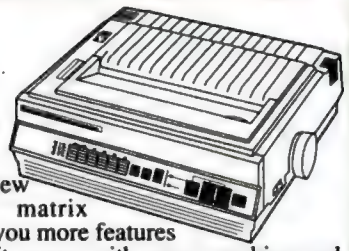
The most popular word processor is now even better than ever! Version 5.0 adds multiple font support, graphics integration, page preview and much more. WordPerfect 5.0, still retains its feel and ease of use that made it #1. Combine this with the best support in the industry and you can't lose.

TOSHIBA T1000 $749



The Toshiba T1000 is the perfect second PC! It comes with 512K of ram, a 720K floppy drive, a supertwist LCD screen and MS-DOS in rom! All this in a battery-powered 7 pound package. A 768K ram card is just $269 and can be set as base, expanded, or a non-volitile ram disk.

Panasonic KX-P1124 24 Pin Printer



$309

Panasonic's new 24 pin dot matrix printer gives you more features per dollar! It comes with paper parking and three paper paths for easy handling. The EZ-set operator panel lets you choose from five fonts, six pitches, perf cut and more. Its 11.7" carraige is perfect for envelopes or single sheets in landscape mode. All this and a two year warranty.

HARDWARE

PRINTERS

	LIST	FAST
ALPS		
Allegro 24	499	319
Citizen		
120D	229	145
180D	259	165
MSP40	449	299
Tribute 124	599	429
Diconix		
150P	499	299
Epson		Call
Fujitsu		
DL3400	995	549
NEC		
P2200	569	339
P5200	799	509
P5300	1049	669
LC890	4799	Call
Okidata		
182 Plus	319	219
320	499	329
390	699	469
393	1499	949
Panasonic		
KXP1180	300	Call
KXP1191	400	Call
KXP1124	529	309
KXP1595	749	419
KXP1524	949	519
KXP4450	2595	1499
Star		
NX1000	289	169
NX2400	499	309
NB2410	699	429
Toshiba		
P321SL	749	459
P341SL	999	599
P351SX	1499	929

BOARDS

	LIST	FAST
AST		
Hot Shot 286	645	339
Six Pak Plus 64K	210	119
DTK		
286 10mhz M/B	499	249
XT 1.2mb FDC	79	45
Everex		
1200B Int Modem	149	69
2400B Int Modem	249	129
Genoa		
Super EGA Hi-Res+	399	169
Super VGA #5100	445	239
VGA Hi-Res #5200	645	359
Hercules		
Graphic Card +	299	169
Intel		
8087-2	250	149
80287-10	480	249
Above Board Plus	795	419
Orchid		
ProDesigner	499	299
Tiny Turbo 286	445	269
Twin Turbo 12mhz	645	359
Paradise		
Autoswitch 480	349	Call
VGA Plus	399	259
VGA Plus 16	499	299
VGA Professional	799	Call
Practical Peripherals		
1200B Int Modem	99	65
2400B Int Modem	199	149
Prometheus		
Promodem 2400B	199	129
Promodem 2400G	249	159

	LIST	FAST
The Complete PC		
Answering Machine	349	209
Fax 4800	399	235
Hand Scanner 400	249	149
USRobotics		
1200 Baud Internal	149	69
1200 Baud External	179	89
2400 Baud Internal	249	119
2400 Baud External	279	149
Video 7		
Fast Write VGA	549	335
Vega Deluxe	379	Call
Vega VGA	499	259
V-RAM VGA	799	469

LAPTOPS

Megahertz Modems		
2400B Toshiba	299	149
2400B NEC, Epson Mitsubishi or Zenith	399	199
Mitsubishi		
MP-286L Dual	3195	1879
MP-286L 20mb	4595	2449
NEC		
Multispeed EL II	2295	1449
Multispeed HD	3695	2249
Toshiba		
T1000	1249	749
T1200F	2099	1369
T1200FB Backlit	2399	1499
T1200HB Backlit	3599	2399
T1600	4999	Call
T3200	5799	3495
T5100	7499	4495
Zenith		Call

MONITORS

	LIST	FAST
Magnavox		
7BM749 VGA	229	149
9CM082 VGA	649	419
Mitsubishi		
1409 RGB	399	259
1410 EGA	599	399
Diamond Scan 1381	799	479
NEC		
Multisync 2a	799	Call
Multisync Plus	1399	869
Princeton		
Max15	389	Call
Ultrasync	849	489
Ultra 16	1375	859
Seiko CM1430	995	599
Sony		
1302 Multiscan	995	659
1303 Multiscan	825	469
Zenith 1490	999	599

DISK DRIVES

	LIST	FAST
Miniscribe		
40MB AT #3650	499	319
Mitsubishi		
40MB AT MR535 22ms	825	399
Seagate		
20MB XT Kit #225	599	267
30MB XT Kit #238	699	287
40MB AT #251	899	349
40MB AT #251-1	999	449
80MB AT #4096	1199	549
Toshiba		
360K Floppy	119	69
720K 3.5" Floppy	149	79
1.2MB 5.25" Floppy	149	79
1.44MB 3.5" Floppy	189	99

Call On Non-Listed Items

SOFTWARE

Database

	LIST	FAST
Clipper	699	399
DataEase	600	389
dBase IV	795	449
dBXL Diamond	199	105
Foxbase Plus	395	185
Foxbase Plus Lan	595	295
Paradox	725	429
RapidFile	295	179
Rbase for DOS	700	Call
Reflex	150	90
Q & A	349	199

Desktop Publishing

Byline	295	175
GEM Desktop Pub.	299	169
Pagemaker 3.0	795	Call
PFS:First Publisher	129	69
Publisher's Paintbrush	285	149
Ventura 2.0	895	489

Financial

Bedford Integr. Acct.	249	139
BPI		Call
Computer Associates		Call
DAC 3.0	99	59
DAC Payroll 3.0	99	59
Dollars & Sense	179	99
Managing Your Money	199	117
Peachtree Complete II	199	149
Turbo Tax 1040	75	42

Graphics

	LIST	FAST
Deluxe Paint II	105	67
First Graphics	129	Call
Freelance Plus	495	Call
GEM Artline	495	269
GEM Draw Plus	299	165
Generic Cadd Level 3	200	97
Graph Plus	495	299
Harvard Graphics	495	Call
Perspective Jr.	149	85

Integrated

First Choice	159	Call
Works	149	89
Windows 286	99	59
Windows 386	195	117

Mice

Logitech C7 Serial/Bus	119	65
Logitech HiRes Bus	150	79
Microsoft Serial/Bus	150	95
Microsoft W/ Windows	200	129
OmniMouse	89	45
PC Mouse II Serial/Bus	149	82

Power Protection

Curtis Ruby Plus	115	59
Datasheild 85	90	50
Datasheild 100	99	57

Programming

	LIST	FAST
Macro Assembler	150	89
Norton Guides (Specify)	100	58
Turbo Basic	99	60
Turbo C 2.0	149	90
Turbo Pascal 5.0	149	90
Quick Basic	99	60
Quick C	99	60

Spreadsheets

Allways	150	82
Excel	495	Call
Lotus	495	Call
Lucid 3-D	149	79
Quattro	248	149

Utilities

CoreFast	149	71
Desklink	170	95
Desqview	130	73
Fastback Plus	189	99
FastTrax	60	37
Formtool	95	54
Laplink Plus	140	77
Norton Advanced	149	74
PC Tools Deluxe	80	36
Sidekick Plus	195	119
XTree Pro	129	61

Word Processors

	LIST	FAST
Ami	149	89
Easy Extra	99	55
GEM First Word Plus	199	117
Grammatik III	89	49
Manuscript	495	Call
Multimate Adv. II	565	247
Professional Write	199	109
Rightwriter	95	49
Sprint	195	119
Q & A Write	199	109
Webster's Writer	60	47
Word	450	Call
Word Perfect	495	Call
Word Perfect Library	129	60
WordStar Prof. 5.0	495	219

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$495 Employee Handbook Maker

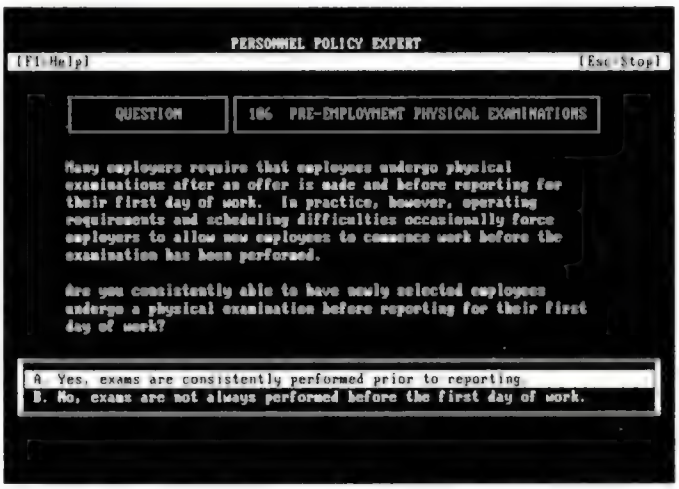
PC HANDS ON

BY BRUCE BROWN

KnowledgePoint's $495 *Personnel Policy Expert* takes the pain out of creating employee handbooks. The menu-driven package prompts you to answer questions about your company's policies on such topics as sick leave and termination, then produces a manual based on your answers. Text screens explain your options in depth.

Personnel Policy Expert's editor uses *WordStar*-like cursor-movement commands with pull-down-menu operations. You can also use your own word processor if you prefer. KnowledgePoint will print and bind your handbook for a fee, but you can print the ASCII format text on any printer, adding such attributes as boldface and underlining, or you can create an on-line manual.

To put the product to the test, I set out to produce a handbook for my own small company. I created a complete employee handbook in about 6 hours—on a 4.77-MHz XT with an 80-millisecond hard disk. And that time included my reading every text screen.



Personnel Policy Expert *creates an employee handbook based on your answers to questions about such topics as preemployment physical exams.*

Although written for the whole U.S. market, the package is based on California law, so your handbook should be reviewed by your attorney.

For any small business, human resources department, or management consultant (a consultant version is available for an additional $1,000), *Personnel Policy Expert* is a time-saving, easy-to-use tool. It's also an impressive, practical application of AI-like software.

List Price: *Personnel Policy Expert*, Version 1.0, employer version, $495; consultant version, $1,495. Update subscription for 1 year, $95; for 3 years, $195. **Requires:** 512K RAM, DOS 2.1 or later. Not copy protected. KnowledgePoint, 1311 Clegg St., Petaluma, CA 94952; (800) 727-1133.

CIRCLE **431** ON READER SERVICE CARD

Practical Programming Guide for OS/2

PC BOOK REVIEW

BY ROBERT L. HUMMEL

OS/2 Programming: An Introduction, by Herbert Schildt, provides just the right mix of a clear tutorial, practical programming examples, and a reference guide to bring you up to speed on OS/2.

OS/2 Programming: An Introduction doesn't force you to wade through chapters on how neat OS/2 is before getting practical. Whether you're an experienced C programmer looking to write programs for OS/2 or a nonprogrammer who needs to know the basic facts, this book gives you the essentials without the hype.

You can safely skim or skip the first chapter's overview of the Intel 80x86 family architecture and the history of DOS and OS/2. The book gets down to serious programming in chapter 2, where Schildt presents C code you can compile and run under OS/2 immediately. With this hands-on experience you get a sense of real accomplishment. More important, you're motivated to study the explanations that follow.

In his next ten chapters, Schildt covers advanced topics like keyboard monitors and dynamic-link libraries in the same clear, straightforward manner. As you become more experienced, you'll find the many tables in the book useful for reference. And, as a bonus for the really ambitious, a section on programming for the OS/2 Presentation Manager graphical interface is included.

Learning to program for OS/2 isn't easy. But *OS/2 Programming: An Introduction* makes the task more pleasant and can save you hours of frustration.

List Price: *OS/2 Programming: An Introduction*, by Herbert Schildt, $21.95; with companion disk, $24.95. **ISBN:** 0-078-81427-8. Osborne/McGraw-Hill, 2600 Tenth St., Berkeley, CA 94710; (415) 548-2805.

CIRCLE **432** ON READER SERVICE CARD

Smart ASCII Imports for Ventura Publisher

PC HANDS ON

BY EDWARD MENDELSON

Vtune is the ASCII-import filter that should have been built into *Ventura Publisher*. Emulation Technologies' $99 utility is a pricey but convenient addition to the bag of tricks that *Ventura* uses when importing text that's been prepared in other word processors or text editors. *Vtune* appears on the Load Text/Picture menu along with *Ventura*'s native import filters, but it has options and features that none of the other filters offer.

Vtune converts ASCII text intelligently and according to your exact preferences. If you type (c) in your text, *Vtune* can convert it into the copyright symbol—and it does the same for the registered and trademark symbols. It can convert three periods into a correct ellipsis.

Vtune removes extra carriage returns between paragraphs, and it even converts those annoying ASCII files with carriage returns at the end of each line. If you want to convert any sequence of two spaces into an en space or three spaces into an em space, *Vtune* will do it automatically. It can convert different combinations of dashes or underlines into en and em dashes and change fractions typed in the form 7/8 into any typographic style of case fraction that your printer supports. You also get more-intelligent and -flexible conversions of dashes and quotation marks than *Ventura* provides.

With luck, you won't need *Vtune* with the next version of *Ventura Publisher*. Meanwhile, it's an indispensable timesaver.

List Price: *Vtune*, $99. **Requires:** *Ventura Publisher*, Version 1.1 (with Patch 2) or 2.0. Not copy protected. Emulation Technologies Inc., 1501 Euclid Ave., Cleveland, OH 44115; (216) 241-1140.

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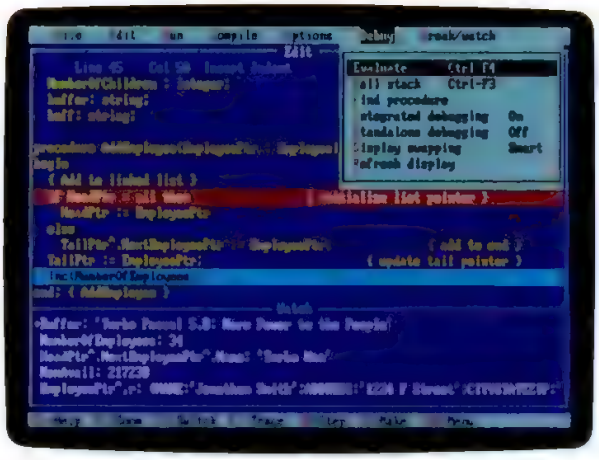
Through Basic training? Graduate to Turbo Pascal.

Turbo Pascal® is easy to learn, fast, powerful, and the most popular Pascal compiler in the world.

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CIRCLE 137 ON READER SERVICE CARD

Corel Draw! Combines Power, Simplicity

PC HANDS ON

BY LUISA SIMONE

In a software category where powerful features and ease of use have historically been mutually exclusive on the PC, *Corel Draw!* stands as an exception. This new vector-based drawing package truly deserves the exclamation point that rounds out its name.

The first thing you notice when you open *Corel Draw!* is that the screen isn't cluttered. In fact the toolbox, which runs down the left of the display, contains only nine icons—and only three of those are actually drawing tools.

At first, this may seem to be a drawback. But you soon discover that you can achieve sophisticated, professional-looking drawings without lots of icons, gizmos, menu choices, and dialog boxes.

Where other drawing packages give you four different tools for drawing four different types of lines, *Corel Draw!* gives you a pencil. If you click the mouse button and release it, and then move the mouse and click again, the program assumes you want straight lines. If you move the mouse while holding the button down, the program assumes you want curves.

Moreover, *Corel Draw!* decides how best to fit the curves to the movements you've made. By having the program do the hard work—like deciding whether a cusp curve is better than a symmetrical curve—the act of drawing becomes easier.

Of course you can edit any straight line or bezier curve. In fact, double clicking on a curve pops up a special menu to do just that.

The power of the tools makes special effects incredibly easy. For most special effects, it isn't even necessary to go to a menu. Double-click with the Pick tool turned on and, bingo, you can rotate or skew objects to simulate 3-D. Text can appear to be lying flat on a page. Creating a mirror image of an object requires exactly two mouse clicks and one keystroke. To tint a circle so that it looks like a sphere, you simply choose the Radial Fill option from the toolbox.

Corel Draw! runs under *Microsoft Windows* and takes advantage of all the screen and printer drivers available in *Windows*—including PostScript printers and the HP LaserJet. However, this product isn't entirely *Windows* kosher. I found that the screen sometimes failed to redraw properly—especially if I printed a file at a reduced percentage.

The program uses the windowing environment to segregate your working wire frame drawing from an on-screen WYSIWYG preview. It's a trade-off. The wire frames, which represent only the outlines of objects, are redrawn very quickly, but the preview window eats into precious screen space. I can't say that I liked the trade-off, but I found it workable.

Corel Draw! uses a similar windowing method to much better effect for text entry. Anyone who has ever typed a text correction into a WYSIWYG program knows how frustratingly slow the process can be. *Corel Draw!* brings up a separate dialog box that lets you enter a text string of up to 250 characters in—you guessed it—character mode. It's fast because you don't have to kern and justify type on the fly. And it's logical because the same window contains all of your type specs for that piece of copy.

The package includes about 50 proprietary font outlines and, though the names are unfamiliar, the letter forms themselves closely resemble standard Adobe typefaces.

The text handling features are nothing short of elegant. You can assign special attributes, like typeface and point size, to individual characters within a text string. You can convert text into curves and then edit the outlines to suit your fancy. You can rotate and skew text or fit it to a curved path. These features rival those of some of the best freehand drawing programs on the Mac.

The feature list goes on (and on). *Corel Draw!* can automatically trace a scanned, bitmapped image. I was able to trace a complex outline of Chinese calligraphy from an imported .PCX using two simple tools—Pick and Shape.

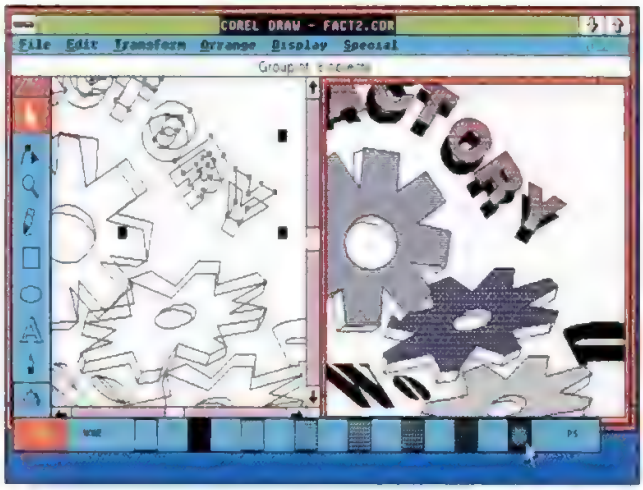
In addition, *Corel Draw!* makes it painless to change the line width and color attributes of the drawing tools. You can, for example, simulate pen nibs of different shapes by altering the rotation of the line. Objects can be filled with patterns or with color. *Corel Draw!* accommodates both the Pantone Matching System (PMS) and the 4/c process model (CYMK).

Only one change could make these customization options better: the ability to save one or two (or three or four) favorite custom tools so that they would be available as menu choices.

Corel Draw! imports and exports files in many useful formats, including .PCX, .TIF, Windows Metafiles (.WMF), and Encapsulated PostScript (.EPS). However, the addition of the .CGM and HPGL formats couldn't hurt.

My only serious problem was a bug in the program. Take my advice and never include the end nodes of a line when you convert straight lines to curves—the program crashes every time. The tech support staff at Corel Systems was aware of the bug and assured me that a fix is on the way.

I suspect that illustrators, art directors, and desktop publishing mavens will be the most likely candidates to use *Corel Draw!*. But, by concentrating not only on the quality of the bezier curves but also on the ease of the learning curve, this program holds out hope for all aspiring artists. PC



To avoid slow screen redraws, Corel Draw! *presents a wire view for drawing creation and editing. A separate preview window lets you see the finished result.*

PC MAGAZINE FACT FILE

***Corel Draw!* Version 1.0**
Corel Systems Corp.
1600 Carling Ave.
Ottawa, Ontario K1Z 8R7
Canada
(613) 728-8200
List Price: $495 (does not include a runtime version of *Microsoft Windows*).
Requires: 640K RAM; *Microsoft Windows* 2.0 or later, *Windows/286*, or *Windows/386*; IBM PC AT or compatible (2MB hard disk space); DOS 3.0 or later.
In Short: A walloping good freehand drawing program that is easy to learn and fun to use. Highly recommended. Not copy protected.

CIRCLE 443 ON READER SERVICE CARD

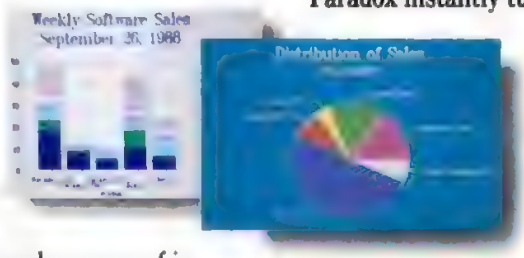
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"Query-by-Example" for example

✓ Use this checkmark and you're using QBE. It's that easy. Let's say you need to know in a hurry which of your Los Angeles customers bought more than 5 pairs of white shoes. First ✓ the customer field, then type "LA," "white," and ">5," and you're done. Paradox gives you the right answer right now. And how much programming to do all that? Zero.

If your database experience so far is limited to the flat-file type rather than relational, or even if a spreadsheet is the only program you've used before, Paradox gets you up and running immediately with just a ✓.

Record-locking and Auto-Refresh make the network safely network

Paradox has become the leading networker because it handles multi-users intelligently. If someone in your group or network has accessed a record, automatic record-locking keeps everyone else from changing it.

That way, two or more people can't change the same data at the same time. (As a bonus, Paradox also tells you *who* is using a record at a particular instant.)

Once the record has been changed by someone in the network, *Auto-Refresh* kicks in *automatically* and updates everything. Everyone in the network is looking at up-to-the-minute information.

Paradox, for the looks of things

Presentation-quality graphics are another Paradox distinction. They give you and your work the professional look. Paradox instantly turns your tables into graphs with *one* keystroke—and in multiuser environments, with a few keystrokes your graph can show up-to-the-minute changes. Not only does everyone get the picture, they get an accurate picture.

Award-winning Paradox Family

Paradox 3.0 is the latest addition to the award-winning Paradox Family. **Paradox OS/2 and 386 received PC Magazine's BEST OF 1988 AWARD in the database category.**

✓ it out

To order a trial version of Paradox 3.0 ($14.95) or a demonstration disk ($4.95), call (800) 345-2888, extension 100. Paradox owners may upgrade ($175.00) by calling (800) 331-0877. (Please have your serial number available.)

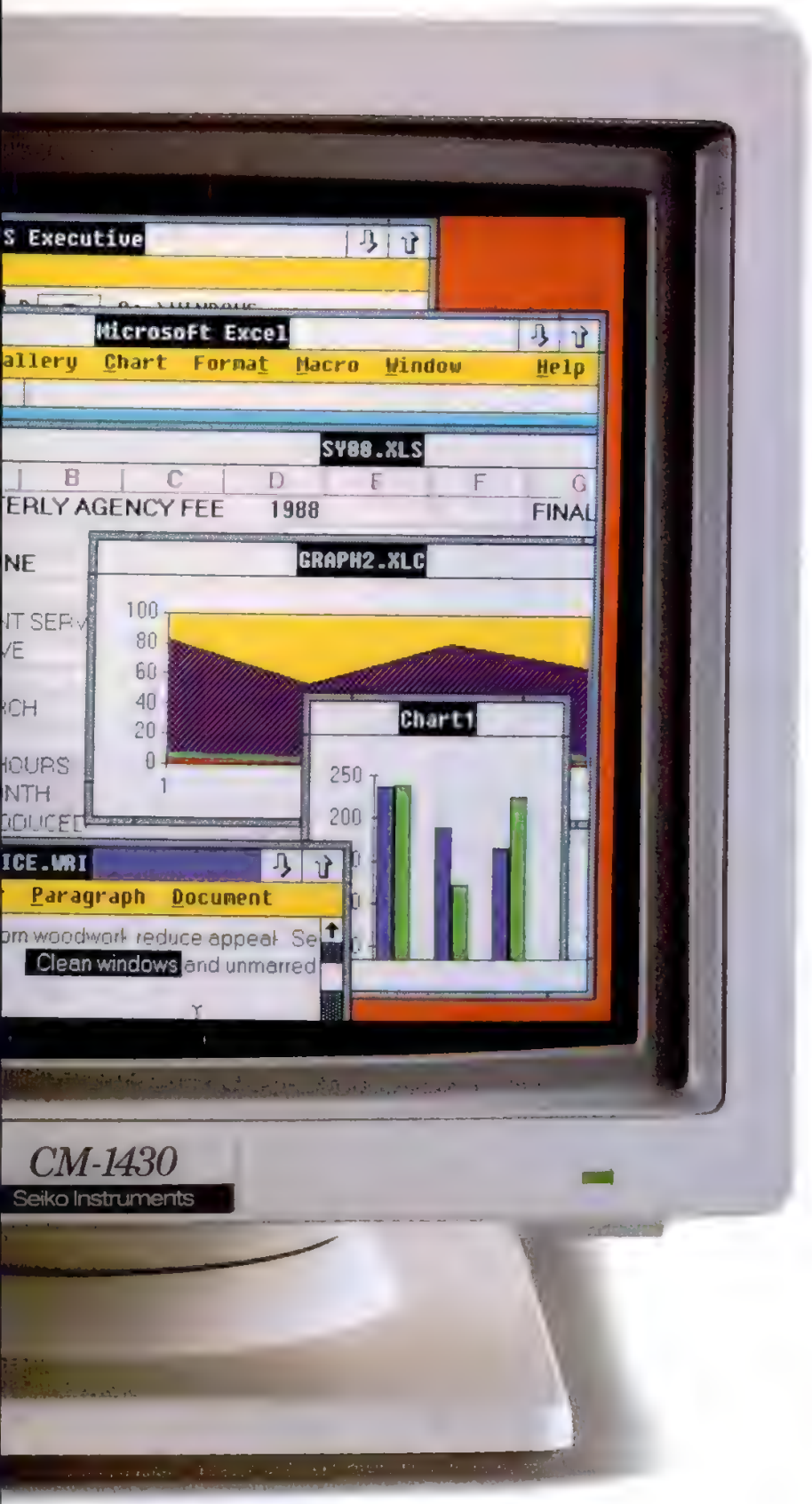


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PC UPDATE

by Paula Seefeldt

SuperCalc5 Links Spreadsheets

Computer Associates International has added spreadsheet-linking abilities to ***SuperCalc5***, its spreadsheet program. Version 5.0 also provides auditing and debugging, improved graphics and output, and LIM 4.0 support. *SuperCalc5* works with *Lotus 1-2-3*, enabling the user to mix commands and use *1-2-3* macros and menus. Users who subscribe to Computer Associates' SupportPlus service will receive a free upgrade. All other registered users and users of competitive spreadsheets can upgrade for $100. New packages retail for $495. Computer Associates International Inc., San Jose, Calif.; (408) 432-1727.

Framework III Increases Memory

Framework III, the decision-support package from Ashton-Tate, has increased its speed and provides 50K additional free memory. Version 1.1 also has an integrated thesaurus, spelling checker, direct import and export of *dBASE* files, and data entry typing. New spreadsheet features include regional recalculation and the ability to view multiple spreadsheets simultaneously. Upgrades are free to all registered users, and new packages retail for $695. Ashton-Tate Corp., Torrance, Calif.; (213) 329-8000.



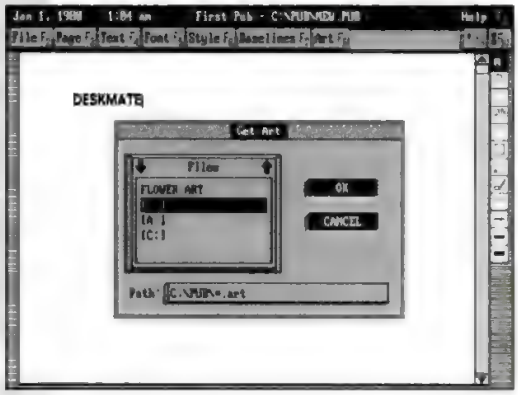
Framework III *provides a spelling checker.*

WordStar 5.5 Adds Pull-Down Menus

WordStar, the word processing program from MicroPro International, now provides comprehensive connectivity with other packages as well as LAN and graphics support. Version 5.5 refines the Advanced Page Preview feature by allowing users to view documents on-screen and adds Systems Application Architecture pull-down menus. MicroPro is also introducing a Corporate Support Program, which includes volume purchase and site licensing agreements and separate documentation pricing. Upgrades are $39 for users of *WordStar* 5.0 and $119 for all other users. New packages are $495. LAN upgrades from Version 4.0 are $119, and new LAN packages retail for $695. MicroPro International Corp., San Rafael, Calif.; (415) 499-1200.

PFS:First Publisher Incorporates DeskMate

Software Publishing has released a color-enhanced version of ***PFS:First Publisher***, its desktop publishing package. The new version runs under *DeskMate* and supports VGA and the Tandy PL 1000 laser printer. Registered users can upgrade to *PFS:First Publisher–DeskMate* for $45. New packages retail for $149. Software Publishing Corp., Mountain View, Calif.; (415) 335-2080.



PFS:First Publisher *runs under* DeskMate

Dolch P.A.C. Increases Speed

Dolch Computer Systems has added a 25-MHz zero-wait-state microprocessor to the **Dolch P.A.C.**, its 386 portable computer, for increased speed. In addition, the enhanced Dolch P.A.C. includes a 64K disk cache and an SCSI interface with an Electroluminescent flat-panel display, to provide a wide range of ambient lighting. Dolch P.A.C. retails for $9,495. Dolch Computer Systems, San Jose, Calif.; (408) 435-1881.

AccountMate Works with dBASE IV

SourceMate Information Systems has added ***AccountMate*, Version 2.0 Plus IV**, to its integrated *dBASE* accounting software. Version 2.0 Plus IV provides compatibility with Ashton-Tate's new *dBASE IV* database language as well as *dBASE III Plus*. Prices for the new *AccountMate* modules range from $295 to $895. SourceMate Information Systems, Mill Valley, Calif.; (800) 877-8896.

Micrografx Designer Adds OS/2 Compatibility

Micrografx Designer now provides compatibility with the OS/2 Presentation Manager. Version 2.0 also offers automatic gradient fills, auto-trace, bezier-curve editing, and spot- and process-color separations. New Import and Export graphics filters are available, and crop bitmap and mirroring are included. Version 2.0 is free to Micrografx ETSS subscribers and to users who purchased after February 1, 1989. Upgrades are $100 for all other registered users. New packages are $695. Micrografx Inc., Richardson, Tex.; (214) 234-1769.

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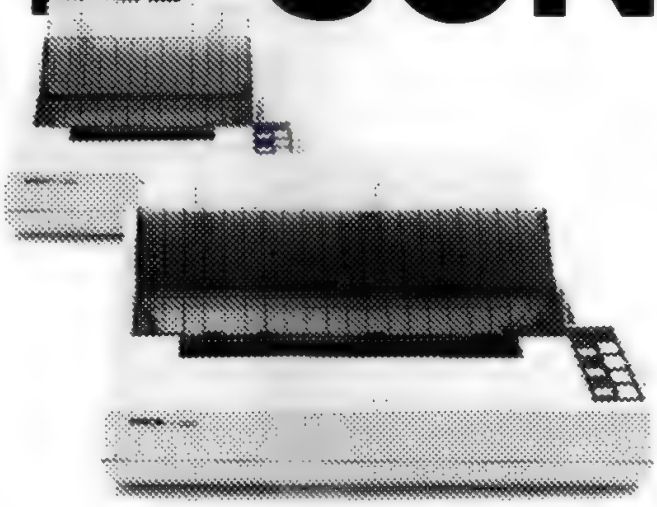
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—*AP story in the Missoula (Mont.)* Missoulian, *December 21, 1988*



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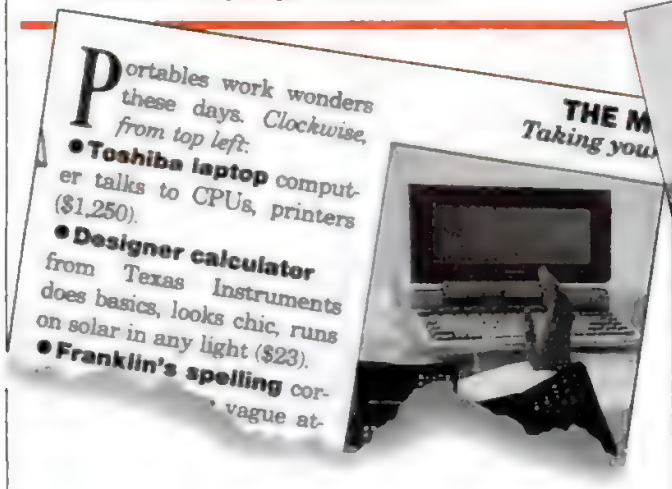
"Objects are the latest buzz word. For a long time, there was only Smalltalk, now there's a whole troup [sic] of players including Actor, Objective C and C++. So we start out this issue with a four-piece trilogy on objects: complete with theory, examples and projects. (Space is no object.)"

—Micro Cornucopia *(November-December 1988)*

Lucky for Us the Disks Aren't Copy Protected

"To qualify [for the *SuperCalc5* academic upgrade], the user needs to mail the title page of his or her current spreadsheet manual, the disks themselves (or a photocopy thereof), and proof of university enrollment or affiliation to the company."

—Academic Computing, *November 1988*



Why PC Magazine *doesn't publish recipes and decorating tips (because we're not qualified): "The Mighty Minis" article in* Better Homes & Gardens *(December 1988) succinctly summarizes portable computer technology.*

When You Come Right Down to It, Maybe Scroll Bars Aren't Such a Hassle

"How to get a full-page display in Ventura Publisher for $69: By enabling your EGA/VGA board to store a full-page image of your document, The Soft Kicker gives you instant access to any part of that page. All you have to do is move your house. No more hassling with scroll bars."

—*Aristocad Inc. postcard flyer*



A little knowledge is a dangerous thing: Nice try by the caption writer for the Financial Times of Canada *(October 17, 1988). The phrase has previously been applied, more correctly, to Bill Gates.*

The Cause Is Pretty Straightforward And It Has Nothing to Do with VDTs (Even Better Homes & Gardens Knows That)

"An association between intensive VDT use and first-trimester pregnancy was established, said Michael Polen, co-author of the Kaiser-Permanente study. 'But we didn't have information to say what might have caused that.'"

—Digital Review, *November 21, 1988*

Have you seen anything offbeat, unusual, or just plain dumb about the computer industry? If so, then send submissions to Communiqués, PC Magazine, *One Park Avenue, New York, NY 10016. Contributors whose entries are used will receive $50 and a* PC Magazine *T-shirt. In case of duplicate entries, the earliest postmark will prevail. Winners this issue include: Lane Coddington (platinum software), A. J. Boron (wizard of DOS), Mark Blaskey (laptop talks to CPUs), Thomas Hodges (first-trimester pregnancy), Greg Stricherz (four-part trilogy), Ken Lerner (move your house), Marc Kessler (photocopy thereof).*

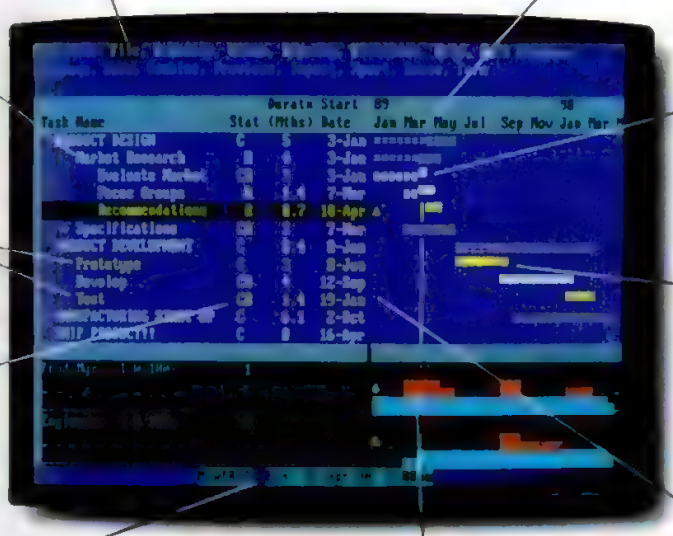
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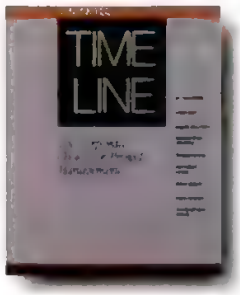
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■ BILL MACHRONE

WHAT CAN THE MAC TEACH US?



As Macintosh developers port their magic to the Presentation Manager, a look down the aisles of Macworld Expo is like gazing into a crystal ball. 1990 looks good for the PC.

I'm a glutton for punishment.

I attended the recent Macworld Expo in San Francisco to get a fix on the state of the Macintosh art. What I got was a lot of abuse. Everyone who knew me or recognized the *PC Magazine* logo on my lapel had the same refrain: "Whatsamatter, Bill, have you finally found out that computing can be fun?"

Indeed, computing on a Macintosh can be fun. It can also be cute, or tedious, or precious. But whatever else it is, it's intensely visual. Some Macintosh programs have no parallel on the PC and aren't likely to for some time to come.

One of my favorite examples is *Digital Darkroom*, from Silicon Beach Software. This brilliant program lets you take scanned photographic images and manipulate them to your heart's delight. You can combine, clip, burn in, dodge, hold back, sandwich, and retouch images. You can proof your handiwork on a laser printer and print it on a phototypesetter. It's one more reason why Macintosh dominates desktop publishing. But, like any other vertically oriented package, if you have to ask "What would I use it for?" you don't need it.

I also saw a number of full-motion video products, in which images from laser disks and videocassettes can be combined with computer graphics on the screen. One of the most interesting is MacroMind's *Director*. It offers video images combined with painted images, graphics from other programs, text, and digitized sound. It animates objects, allowing you to rotate in several axes, zoom, pan, and otherwise make them jump through hoops. The results are presentation graphics, desktop video presentations, and instructional programs, the likes of which normally require a $100,000 video-editing facility. Sure, there are half a dozen videodisk systems available for the PC, but none with *Director*'s versatility or authoring capabilities.

It's become abundantly clear that no computer is a success unless it succeeds in the business market. All of the Commodore Amiga's video prowess doesn't amount to a hill of beans beyond the TV and video graphics fields, because the Amiga isn't regarded as a business computer. The Macintosh wasn't at first, either. The original 128K Mac was an incredibly limited machine, not unlike the original 64K PC. But IBM designed the PC to be expandable, whereas it took a veritable revolution at Apple to make the Mac into a business machine.

Now, with its graphical leadership,



Illustration: Deb Hoeffner

Macintosh is the bellwether for the applications we'll ultimately see on the PC. One key area will be forms processing. Paper isn't going away. Rather than ushering in the era of the paperless office, the computer has generated far more paper than ever. But it's also revolutionizing the seemingly mundane world of forms processing. We'll soon be taking an in-depth look at forms processing in *PC Magazine*. Forms will be with us for the foreseeable future. So the best thing that computers can do is accommodate them. That turns out to be considerably more subtle and tricky than one might expect. The trick isn't so much to represent accurately how the form looks on the screen but to simulate how the form is actually used.

A perfect example is *MacInTax*, by SoftView, currently the most popular Mac-based tax package. This program starts with a reasonable simulacrum of a 1040 form on the screen. The familiar look is important; you can relate to it (with fear and loathing, perhaps) immediately. But that's where the similarity ends. A double-click almost anywhere on the form gets you help about that part of the form. You document entries that are actually subtotals of other figures in windows that open up to show you itemization sheets or other parts of the form. *MacInTax* performs validity checks so that you can't, for instance, take a spouse-related deduction if you've checked "single" elsewhere on the form.

To date, much of the forms-processing software has centered on scanned images of existing forms and making the blank areas editable on the screen. SoftView

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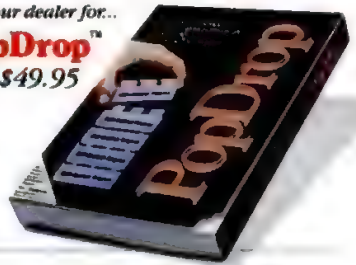
The PopDrop "PopView" Screen. From here, you can see which programs are loaded, how much memory each consumes, and how much is free.

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■ BILL MACHRONE

president Kathy Lane says, "It's much more important that a form look the way the user expects it to look than be a slavishly accurate copy of the original." She elaborates on the point, adding that the form has to act the way the user expects it to act, as well. "The 1040 is a perfect example of a form that requires you to jump around, turn it over, use different parts of the form. The computer can do that far better than paper." And so it does.

THE PC PERSPECTIVE The more obdurate among you are wondering, "What does this have to do with me? All my applications are character-based." Not for long.

SoftView, for instance, already offers a *Windows*-based version of *MacInTax*, called *TaxView*. The *Windows* product is certainly a competent performer on fast machines. It's effective but somewhat slow on 8-MHz ATs and slower machines.

Products like *PageMaker* are virtually indistinguishable in their Mac and PC versions. Everywhere I went at Macworld Expo, people spied my *PC Magazine* badge and whispered, "We've got a Presentation Manager version of this in the works." Why so furtive? Because Macintosh users generally believe that PC users are a benighted lot and that developers who waste their time on the PC are turncoats.

Developers, however, are inexorably pulled toward the PC market. They see the incredible size of the installed base, the growth rate, and the increasing number of machines that are graphics-capable. This last point is the most critical. The average machine going into business today is an 80286 with VGA graphics, a meg or two of memory, and a hard disk. Yet obstacles remain. Memory is still a factor—the Presentation Manager really wants 3 or 4 megabytes, so users will still have to buy more.

Once the constraints of DOS and *Windows* are lifted, however, the designers will be free to port applications or to use their Mac feature-sets as the templates for new, PM-optimized programs. 1990 will be the go-ahead year for the Presentation Manager, the year when the seeds planted in the Macintosh market will bear fruit.

After all is said and done, the improvement will be graphically clear. PC

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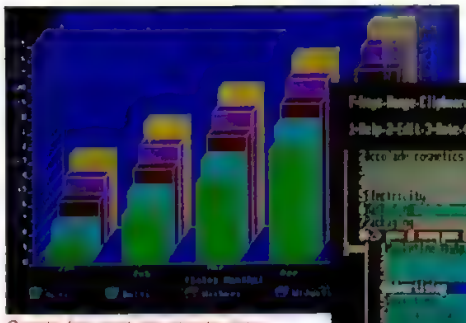
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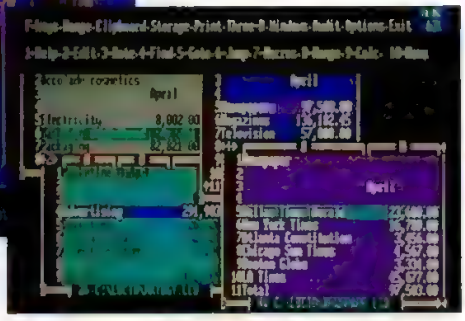
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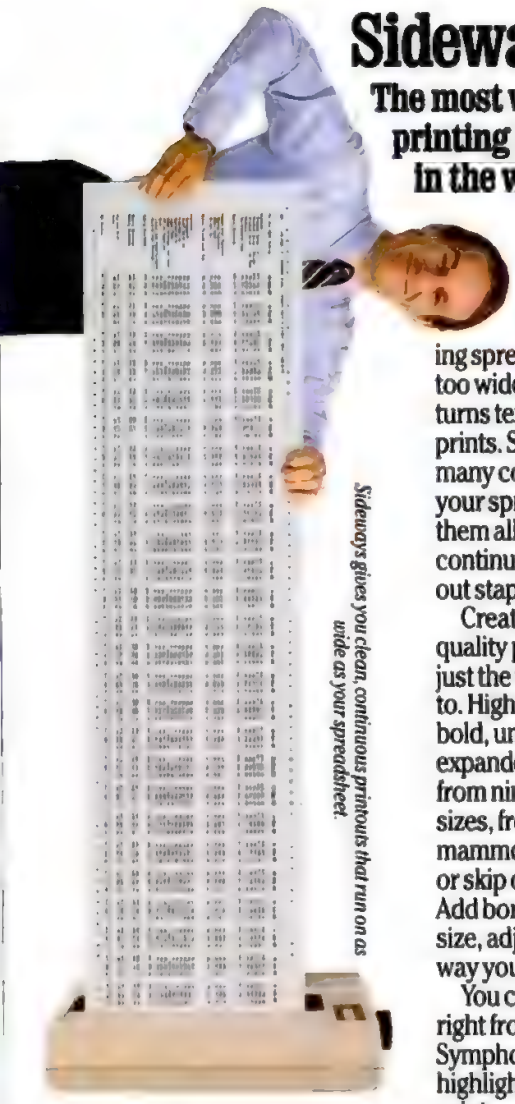
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PC MAGAZINE

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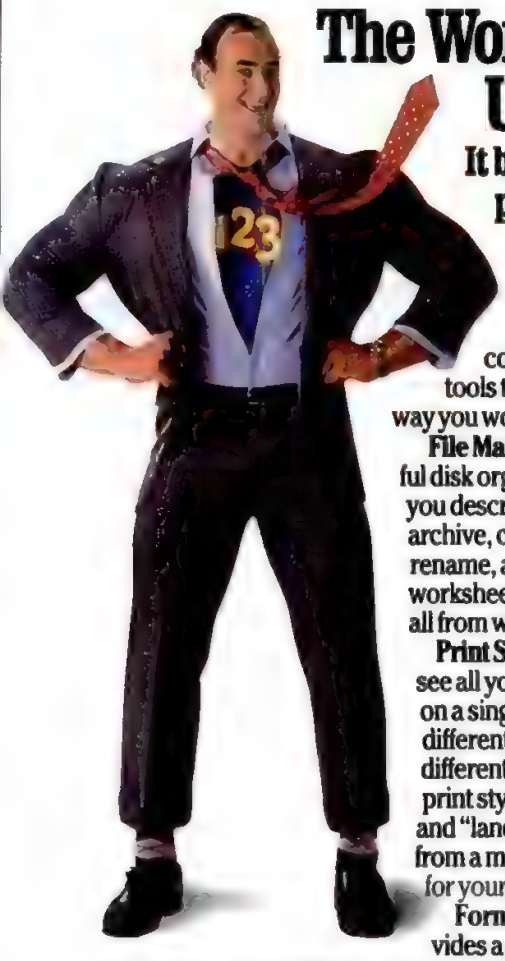


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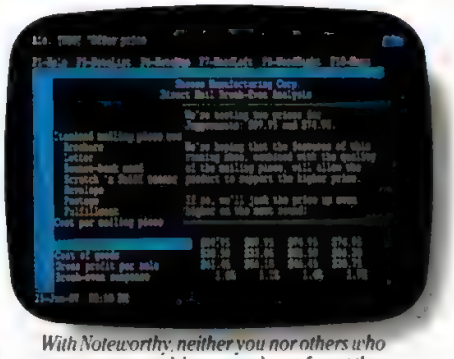
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■ JOHN C. DVORAK

DVORAK'S HALL OF INFAMY



Sixty products have been inducted into Dvorak's Hall of Infamy. To find out how to make your product flop next year, take a look at the Seven Surefire Ways to Fail.

In 20 years, very few of the computer companies that we know and love will still be with us. Many will have zigged when they should have zagged. Many will be bought out by Microsoft or Lotus (and soon thereafter disappear from the face of the earth), and many will go out of business for reasons unknown. Success in high technology is a phenomenon few can understand and fewer can predict.

One way to examine the phenomenon is to look at the big losers and see what they had in common. So I decided to open Dvorak's Hall of Infamy. I've awarded prizes in three categories. Congratulations to the winners.

■ **The Order of the Tin Fireplug** To make it into the top tier of flops, a product had to be overhyped: declared a superproduct that would change the world. Those honored in this category are IBM's *TopView*, *The Last One*, *Lightning* from Borland, *Jazz*, Gavilan Portable, IBM PC Convertible, PC*jr*, Apple Lisa, Convergent Workslate, Mindset computer, TI 99/4A, HP Touchscreen PC, Fortune computer, Intel 80186/80188 chips, Intel 432 chip, Zilog Z-8000 chip, National Semiconductor 32032 chip, *WordStar 2000*, *Ovation*, DEC Rainbow, *VisiON*, Tandy 2000, Tandy 600, *DR Logo*, UCSD Pascal, *Valdocs*.

■ **The Order of the White Elephant** Next comes the second tier—products that were ill-timed and flawed, but somewhat interesting. They got publicity, but no sales. Worthy of the White Elephant are: Dot Computer, Cullinet's *Goldengate* spreadsheet, *Boeing CALC*, *Context MBA*, *Javelin*, CP/M-86, *R:base Clout*, *Jack3*, Apple III, Intel 8085 chip, IBM Portable, IBM 9000, IBM 370/PC, *Savvy PC*, The Xerox PC, the MAD Computer, TI Professional, *Microsoft Access*, Albert Computer, *EasyWriter*, *WordStar* for the PC*jr*, Commodore PC.

■ **The Order of the Dodo Bird** The bottom tier includes the weird and memorable oddball flops, products in a category by themselves. These include *It* from Martin-Marietta, Dysan/Tabor 3¼-inch disk, Amdek 3-inch disk, Apple Twiggy 5¼-inch disk, Hercules InColor card, IBM's PC Cluster network, JRT Pascal, NEC V-20, Zilog's Z-800 chip, CP/M 68K, DRI Personal BASIC, IBM RT PC.

I hope I haven't left out any of your favorites. Next year, of course, we'll add to this Hall of Infamy. Meanwhile, we have to look at this list (and it's a good one!) to see if we can find some common threads that determined the fate of these products.



SEVEN SUREFIRE WAYS TO FAIL: 1. Release an inferior product into a marketplace where a superior product is already well established.

2. Ignore research and user preferences and build whatever *you* think people want.

3. Use drugs and base your decisions on drug-induced logic.

4. Design a product that you can't actually build.

5. Design a product, spend all your money promoting it, and then ship it years later.

6. Produce a product that neither you nor your marketing people can explain to anyone.

7. Give an otherwise decent product a really dumb name.

There's actually an eighth rule:

8. Don't let anyone know about or see the product, especially the press.

Unfortunately, the products in this latter category are the unknown flops—they make up the fourth tier. I'm sure they know who they are and have special secret award ceremonies.

I'd like to personally congratulate these charter members on their making it into the Hall of Infamy.

Now what I have to do is find a good location around Canton, Ohio, or some other little town looking to have a world-famous tourist trap, and we can start a new American institution.

In the meantime, I wish all the newcomers into this business lot of good luck. And remember: if you don't succeed, you've always got Dvorak's Hall of Infamy to fall back on.

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■ JOHN C. DVORAK

INSIDE TRACK

RISC not, want not

The industry watchers all say that **Digital Equipment Corp.**'s announcement of its new workstation, which is based on the MIPS RISC chip, may signal the **next direction** for the desktop computer. Whether we like it or not, the RISC chip is now where it's at. At least in discussions among hardware designers. This amuses me. Since when does DEC set trends? It hasn't set one since it invented the minicomputer decades ago. But the chatter continues.

If you get the opportunity to see the RISC-based **Personal Iris** machine from Silicon Graphics, then you'll see why the architecture is so appealing. It's small. It's fast. Essentially the RISC chips begin life at about 10 mips, and the sky is supposedly the limit.

If **RISC mania,** like the sky, is about to fall on our heads, it will happen when Intel formally announces its RISC chip, **code-named the N-10.** Intel is still the most influential designer of microprocessors in the world. If it endorses the trend, then the trend will **become official.** Meanwhile, Motorola is already promoting its 88000 family of RISC chips, and then there's the SPARC from Sun Microsystems. IBM will say that its RISC-based PC led the way. What does it all mean to you and me? It means we'd **better learn Unix,** because the lazy vendors of RISC chips will port every conceivable flavor of Unix onto these machines. (**Product idea:** a Unix shell that looks like MS-DOS!)

The Carnegie-Mellon **MACH operating systems joined with *Display PostScript*** seems to have the most appeal, bugs or no bugs. It's the combo used by Steve Jobs's NeXT machine and expected to appear on the **newest** incarnation of the IBM RT PC. (I'm told to expect a **600-dpi laser** to appear with the RT.)

So I went out and asked about RISC. What are its **three big advantages and three big disadvantages?** Three advantages: 1) fast, 2) inherently reliable, 3) easy to design a system around. Three disadvantages: 1) requires speedy memory, 2) I/O-bound by design, 3) moves too many problems from hardware to software, where they are **harder** to solve.

This brings me to another question: When will software catch up with hardware? The **Intel 486** is expected to ship shortly. As usual, the company is going to price the chip high and tell everyone that it's some grand superchip that will be used only in advanced workstations. As usual, every cloner in the country will implement it in a **glorified desktop** and show off its speed with DOS and *WordStar*. Already we're hearing that **the 586** may be expected to appear in a year and a half. Where's the software for all these chips languishing? We're still running 8088 software on all of them. Does this bother anyone? My suggestion to Intel or anyone who has an 8088 license: Manufacture a modified 8088 chip designed as a RISC chip to run at **100 MHz.** *That* would floor them!

While Almost on the Subject of IBM Dept.: Did anyone see the late-night TV sales of the **IBM PC Convertible** machines for $499 on one of those **home shopping** shows? Is IBM ready to roll something new? Finally? At this writing, all the rumors indicate that the latest attempt by IBM to penetrate the portables business will be yet another machine that misses the point. Word has it that the newest machine, which gossip mongers call the **portable Model 70,** will have a plasma display and a battery that lasts about an hour maximum. Apparently some researchers determined that typical battery use should be calculated by taking all the Toshibas and **averaging** the battery life. "Let's see, the Toshiba T3100 has a battery life of nil, since it has no battery. Same goes for the T5100. We get 3 hours on a Toshiba T1000. I guess the average user needs an hour!"

Meanwhile, another rumor has surfaced claiming that IBM is replacing the PC Convertible with a **full-color LCD portable** that will blow everything away.

At about the same time I heard that **lulu of a rumor**, I discovered that, down in Atlanta, IBM had a big auction where it sold many of the Boca Raton office machines and a lot of **prototype computers.** Quote from a fellow who got a few of these machines: "Gee, they didn't know how to erase the hard disk. Using the *Mace Utilities* recovery programs I recovered most of the data." Interesting ***AutoCAD* files, company memos,** and other miscellaneous goodies were found. Gee, you'd think they'd know better.

The Lotus Three-Point-Oh Saga Dept.: I received an interesting memo on my section of the PC MagNet Editorial Forum. Supposedly Lotus is working on another version of *1-2-3* to be called 2.5 or 2.6 or something new altogether. It's designed to continue the compatibility and direction of the original product, since 3.0 seems to be headed who knows where. This project is so **secret** that the team is camped in Hartford, Connecticut. I think the theory is that if you force someone to live in Hartford, they'll **speed up** the project just so they can move out quicker. (Just kidding!) Actually, I've always wanted to use that joke about **Microsoft,** which is located in Redmond, Washington, near Seattle. But people up there all claim to love the place. Scientists are studying the phenomenon and figure the tap water is drugged. All I know is that columnist Steve Manes has moved to Seattle and now **he smiles all the time** (no kidding!) and keeps saying, "It's better than New York!" So is Hartford, Steve. PC

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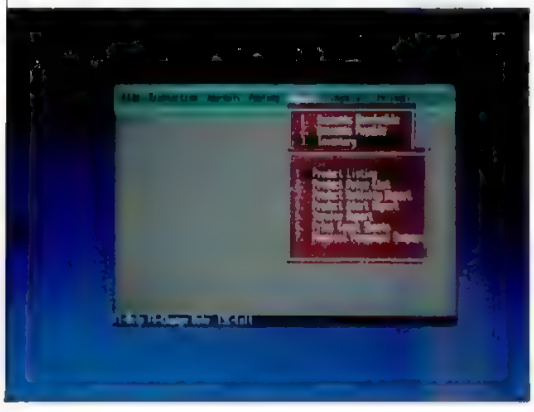
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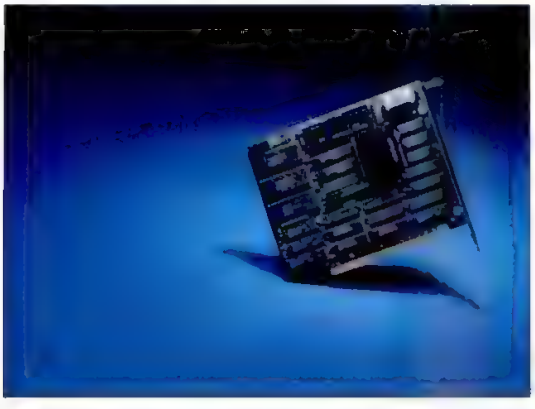
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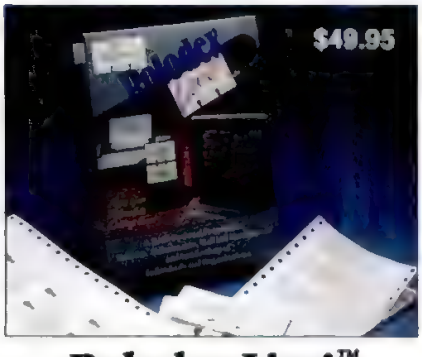
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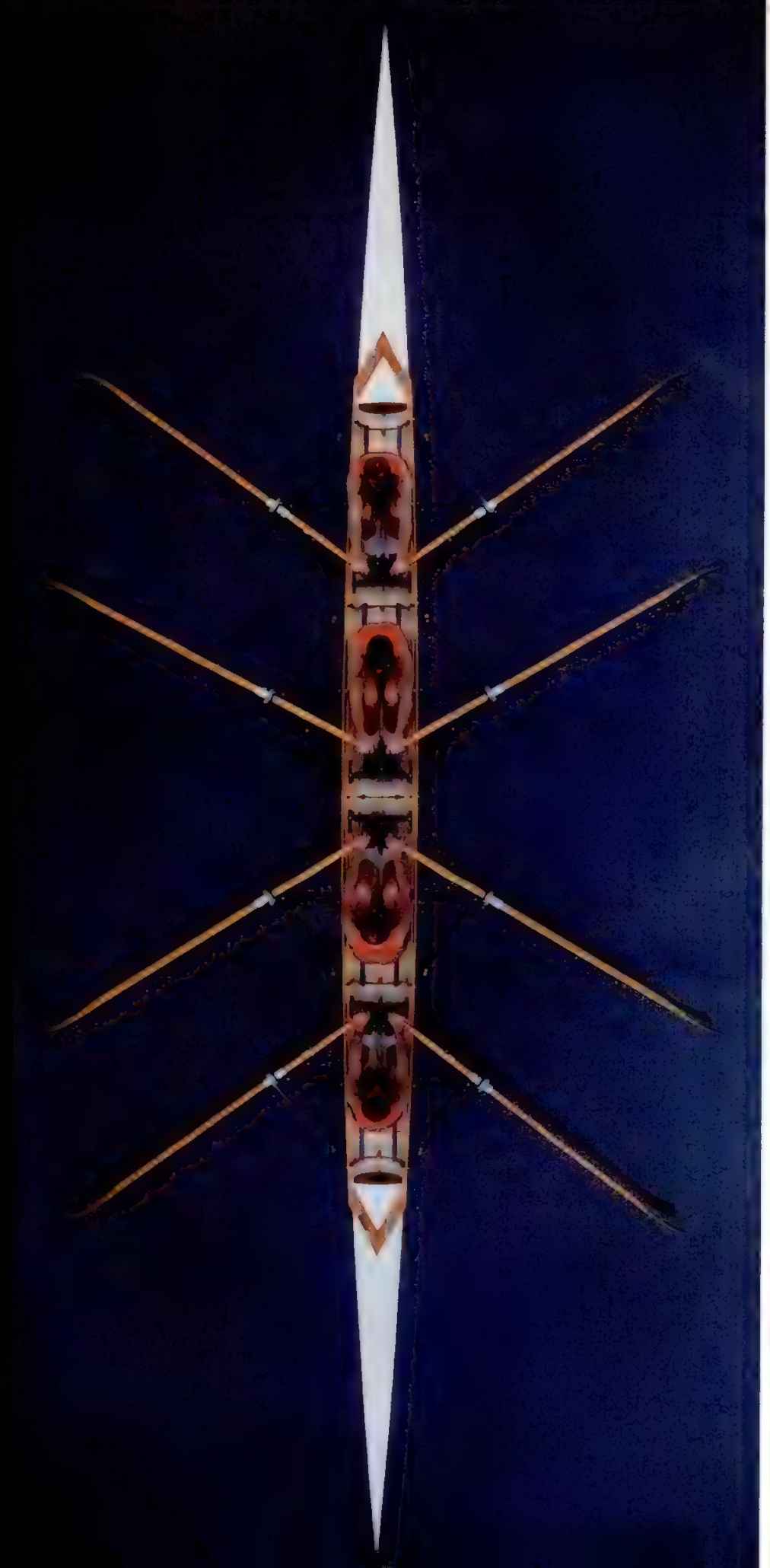
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■ JIM SEYMOUR

THE /2nd ANNIVERSARY



IBM has done a pretty good job of nurturing its PS/2s. But Big Blue hasn't done so well with its software brainchild. Looks like OS/2 is headed for the Terrible /2s.

We're coming up on an important /2nd anniversary. On April /2, 1987, IBM introduced both the new PS/2 line of personal computers and the OS/2 operating system. In a series of roll-out events—from a hall full of cheering dealers in Florida to a basement full of skeptical reporters at IBM's corporate offices in New York City—IBM told us that tomorrow was here and that these /2 product lines would replace what we were using at the time.

But /2 years later, DOS is livelier than ever. And the original PC bus and especially the PC AT bus (now almost universally called the "classic bus," with a tip of the hat to the marketing wizards at Coca-Cola who saved Old Coke when New Coke fizzled in the marketplace) are robust, and dominant in the market.

The progress of these product lines, and their likely futures, are /2 very different stories.

PS TO U /2 Though PS/2s still can't do anything useful that can't be done with an AT-bus PC clone, PS/2 sales are no longer sputtering. And the machines are no longer klutzy, underpowered losers.

We've documented the foibles of the PS/2s and IBM's handling of them since their introduction. We've questioned the numbers IBM reported on its shipments of PS/2s: even when we allowed for European sales and gray-marketing, it was clear those numbers were high, or else a lot of computers were being stacked up in someone's warehouses. And we've pointed out often that the original quartet of PS/2s were not very smart buys, compared with the alternatives from Compaq, Dell, ALR, and a flock of other vendors.

Over the past 6 months, that's changed. PS/2s are selling well. Buyers are happy. While many of us weren't looking, IBM has fixed most of what was wrong with the line.

There was the original Model 50, hobbled by a ridiculously slow hard disk. That got fixed in the newer 50Z. There was the 16-MHz Model 80, which didn't deliver the kind of performance we expect from 386 PCs—especially those delivered in mini-style "tower" configurations. That got fixed with the 20-MHz Model 80, and once again with the Model 70 A21, which is a compact desktop screamer.

There was the forlorn Model 30, with the old bus and the wrong chip. That got fixed, at some loss of face, with the new Model 30 286, which returns an AT-bus machine to IBM's product line and delivers performance on a par with most AT clones—at a roughly similar price.



There was the Model 60—which we might as well forget.

And there was the Model 25, which hasn't done nearly as well as IBM expected in the home and especially in the education market, but *has* found a home in some other applications. I've found Model 25s on receptionists' desks, for example, as dedicated phone-list machines; in telephone-support departments of PC software firms (such as WordPerfect Corp.), where their compact size leaves room in the cubicle for something other than the computer; in PC training classrooms; and in other jobs where a cheap IBM-label PC with a very small footprint is a smart idea.

On balance, the PS/2s have worked out for IBM. Sure, it was stupid to boost the competition and lose a year and a half of desktop 286 sales by dropping the AT-bus line. Sure, screw-ups in bringing out the PS/2s probably cost Bill Lowe his job as the head of IBM's Entry Systems Division. And sure, buying a PS/2 is still an act of faith, betting on the outcome, hoping that someday Micro Channel architecture will be able to do some fancy tricks.

But there's no longer any reason *not* to buy PS/2s.

And OS/2?

A LITTLE /2 MUCH OS/2 is still mired in high costs and little value for the PC user—a fatal pairing. It has to be counted as a failure for both IBM and its development partner, Microsoft.

This may be the year that changes. But

Illustration: Deb Hoeffner

■ **JIM SEYMOUR**

I'm skeptical: I don't think Microsoft or IBM will fix what's wrong with OS/2 anytime soon.

OS/2 is still an oddity, a very expensive way to access more than 640K RAM directly and get more than one program running at once. For most of us, cheaper paths—from *Windows/386* to *VM/386* to *DESQview*—will do just fine till OS/2 delivers real value.

What will that take, exactly?

First, it means moving OS/2 onto the 386 chip as fast as possible. IBM's insistence that Microsoft first develop OS/2 for the aging 286 chip was the biggest boner in the whole /2 saga. Maybe it *was* a matter of keeping the faith with buyers of the PC AT—which, when introduced in August of 1984, was touted by IBM as a machine that would be able to address the 80286 chip's full 16MB of address space directly. Just as soon as we get that new operating system. Which turned out, 4 years later, to be OS/2.

Second, OS/2 has got to become a multiprocessor operating system. There's little mystery why we're not seeing multimaster/multiprocessor architecture add-in cards coming to market for the PS/2s' MCA bus: they'd need a multiprocessor operating system smart enough to know how to hand off jobs to several processors.

■ OS/2 is still mired in high costs and little value for the PC user—a fatal pairing. It's a failure for both IBM and Microsoft.

Until Microsoft writes and IBM distributes that 386-based, multiprocessor operating system—OS/X—a lot of us are going to continue to have /2nd thoughts about jumping to OS/2.

Put simply, OS/2 is still mired in reasons *not* to buy. If you thought my assessment of the progress of the PS/2s ("at least there's no longer any reason not to buy them") was an indictment of the kind of technological leadership IBM has provided, consider how much worse the situation is with OS/2.

Today, /2 years after the first shot, IBM's little revolution is at best a stalemate. If the PS/2s have finally begun to set a meaningful new standard, OS/2 remains a *non*standard, an object lesson in the perils of poor-aim points and feeble implementation for new-technology products. PC



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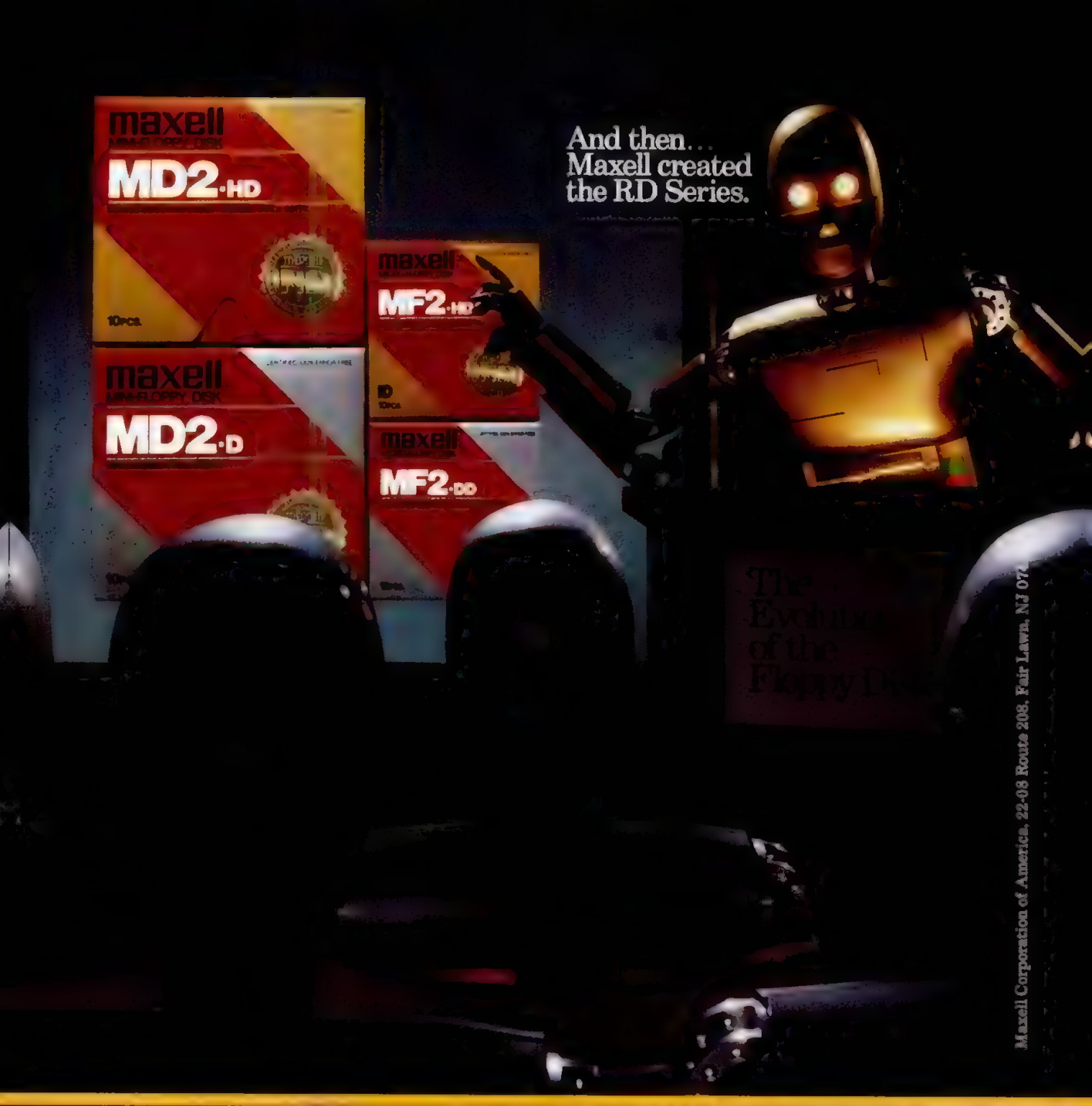
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■ WILLIAM F. ZACHMANN

THE OSF'S CXI: A THORN IN IBM'S SIDE



The news that the OSF has adopted a Unix interface based on IBM's Presentation Manager is more likely to bring victory cries from Hewlett-Packard than from Big Blue.

One might easily assume that it is a triumph for IBM that the Open Software Foundation has adopted what amounts to the "look and feel" of the OS/2 Presentation Manager. After all, IBM is one of the OSF's founders, and IBM's own flavor of Unix, AIX (based on System V, Release 2), is itself the basis for the OSF's "other" Unix.

Curiously, however, IBM played no part in the OSF's adoption of the OS/2 PM–like Common X Interface (CXI) and has shown little enthusiasm for the move. IBM didn't even propose CXI when the OSF requested a graphical user interface (GUI) technology. Rather, it was Microsoft and IBM competitor Hewlett-Packard that submitted the CXI proposal.

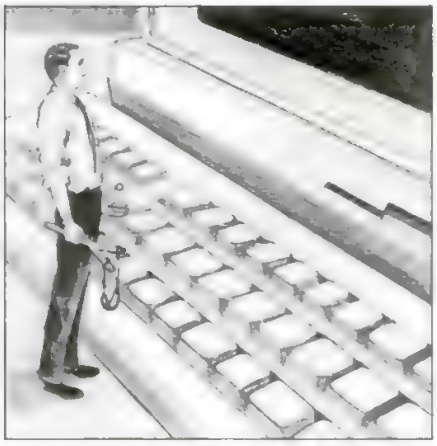
What's more, IBM is playing no part in the interface's implementation. Instead, engineers from Hewlett-Packard and IBM-archrival Digital Equipment Corp. are implementing CXI under the direction of the OSF staff, not only for the OSF version of Unix (the OSF/1 Operating System) but for the AT&T flavor and Unix International's System V, Release 4, as well.

Isn't it strange that what seems, at least on first glance, to be an endorsement of the OS/2 Presentation Manager interface should be supported more vigorously by IBM's competitors than by IBM? After all, doesn't PM also provide the foundation for the Common User Interface for IBM's Systems Application Architecture (SAA)? Has IBM managed to get two of its chief competitors to help spread its own version of computing and preferred-user interface? Is Big Blue coyly manipulating events from backstage? Or are things other than they seem?

In fact, the adoption of the OS/2 Presentation Manager interface (modified slightly by the 3-D look of Hewlett-Packard's OpenView adaptation) for Unix by the OSF represents perhaps the most dire threat to IBM's industry dominance to date. Understanding why will help unravel one of the most complex and convoluted battles the computer industry has seen.

AMBIVALENCE ON STANDARDS An important point to consider is IBM's inherently ambiguous relationship to Unix. Even before that, it's useful to remind ourselves that IBM's stand on Unix is merely an instance of IBM's more fundamental ambivalence regarding standards. Were it not for requirements from customers, it is very doubtful that IBM would have anything at all to do with standardization.

It is proprietary architectures—not standards—that have at all levels (system, operating system, and network) long given IBM the control over its customer base and the high profitability that only a semimonopoly market can provide. The lock-in between proprietary IBM architectures and users' software investment is essential to IBM's industry dominance.



Standards of any sort threaten that dominance in direct proportion to their impact on the industry. Contrary to popular opinion, IBM is not and cannot be a low-cost producer of information-system products. Though IBM's manufacturing costs may be as low or lower than those of smaller competitors, its total costs are higher.

IBM, like the United States and Soviet governments, is a huge bureaucracy and is as likely as they to remain so, despite determined efforts to the contrary from the top. Smaller competitors with a narrower range of products and lower overhead often can, and indeed do, provide quality products profitably at much lower prices.

In addition, IBM's appetite for over $50,000,000,000 in revenues per year cannot possibly be satisfied by a wide-open, competitive market for standardized information systems. IBM *requires* the semimonopoly advantage that traditional proprietary architectures provide.

MARKET DEMANDS However, IBM is also very much a marketing and market-driven company. Demand for standard solutions is a message that IBM has been getting loud and clear from its market for some time. IBM began developing Unix products only when Unix became a re-

Illustration: Deb Hoeffner

■ **WILLIAM F. ZACHMANN**

quirement to win government contracts.

With Unix, as with standards generally, IBM must sail between the Scylla of losing control in the market that proprietary architectures provide and the Charybdis of not providing the standards the market demands. The result is that IBM supports standards no more than the minimum deemed necessary to respond (or at least to appear to respond) to market demands.

IBM's dilemma with Unix is how to go far enough in supporting it to be able to sell to customers who demand Unix, yet not so far as to encourage customers who might be sold proprietary IBM alternatives to consider switching to Unix.

IBM has made every effort to keep its proprietary, "mainstream" products—3090-class mainframes, AS/400 midrange systems, and what were meant to be mostly proprietary desktop systems built on the Micro Channel architecture (MCA) and OS/2 Extended Edition (EE)—separate and distinct from its Unix (AIX) offerings. IBM claimed, contrary to obvious fact, that there was no demand in the Unix market for the Presentation Manager interface or for SAA. In this way, IBM tried to maintain the illusion that Unix is merely a niche market and that it will always remain so.

NICHE MARKETS PREFERRED

IBM's organizational separation of the RT and AIX from the mainstream PS/2 (with MCA and OS/2)—coincident with former Entry Systems Division president Bill Lowe's departure for Xerox—was part of the same campaign. While publicized by IBM as a "renewed emphasis on workstations," the division was at least as much an effort to keep IBM's Unix products confined to niche markets.

So it's no accident that it wasn't IBM but Hewlett-Packard and Microsoft that proposed CXI to the OSF. Acceptance of the look and feel of PM by the OSF is, in fact, a dire threat to IBM. It creates an opening by which SAA applications may easily slip away from the protected world of IBM proprietary systems into what will be a highly competitive and increasingly price-sensitive world of powerful, Unix-based systems that will be capable of taking on mainframe-sized applications.

Acceptance of CXI by the OSF effectively nullifies IBM's attempt to keep Unix segregated from mainstream computing. Given that IBM's effort to move back to a more proprietary environment at the low end with MCA and OS/2 EE is already in trouble, acceptance of what was meant to be an IBM-only interface on Unix only makes matters worse. It simply makes it easier for IBM's competitors to take business away from Big Blue. PC

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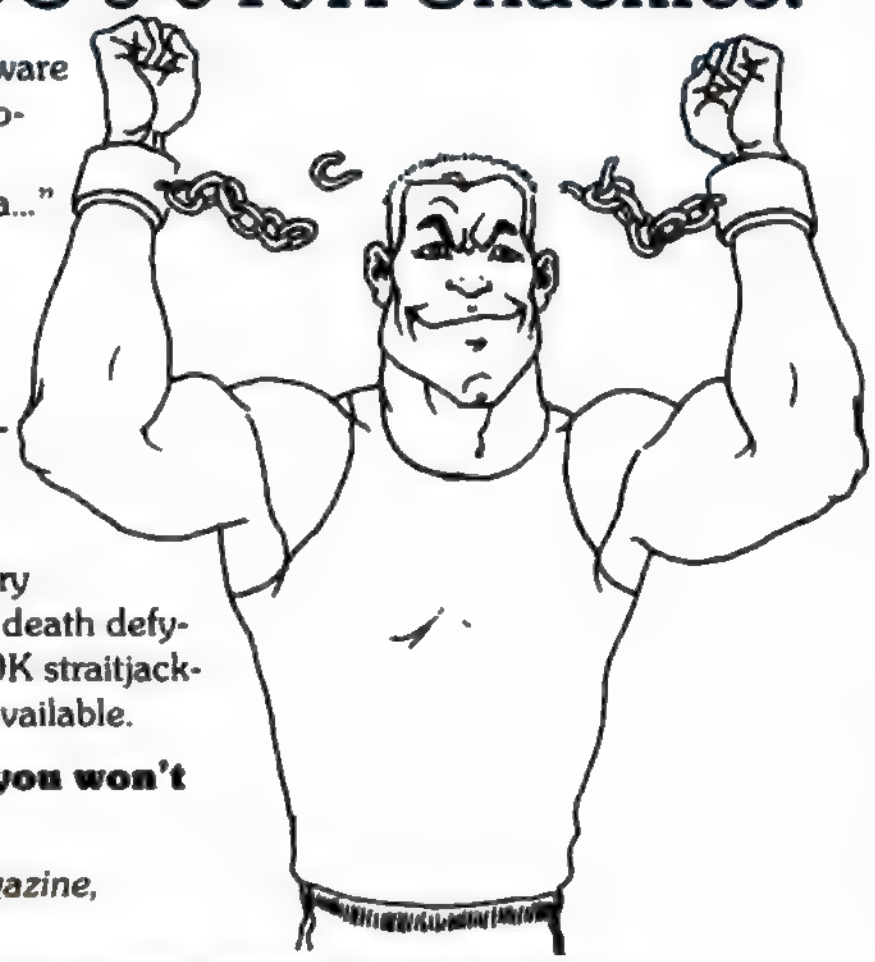
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CIRCLE 167 ON READER SERVICE CARD

How Farsighted Executives Are Using Their PC's For The Fun Of Profit.

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By William J. Spink

For years now you've been hearing about the wonderful things personal computers will do for The Executive of the 80's—at least in theory.

But what's the *reality*? Can a PC help you enjoy your work more and show a greater profit, here and now? According to your peers, the answer is "yes."

"With just a few keystrokes," says Al Lynch, Director of Corporate Planning and Research for JCPenney Company, "I can screen companies, find possible acquisitions or 'scope-out' competitors. It's a real competitive edge."

Walt Casey, V.P. of Communications at ConAgra says, "I spend a lot of time each day poking into this and tracking that. It's *much* easier when you can immediately get the facts from a computer, rather than having to make a series of phone calls."

"One of Dow Jones News/Retrieval's services, QuickSearch, is a Godsend," adds Jim Posner, a respected retail consultant. "It gives me detailed corporate reports within minutes—I don't even have to leave the office."

Instant information: the executive advantage.

To lead in today's marketplace, you need information like *that*," Lynch says, snapping his fingers.

He recalls an example of how Dow Jones News/Retrieval®—the business and financial information service from Dow Jones & Company, Inc.—gave JCPenney Company a real advantage.

"Let's just say that a 'major player' in our industry was being acquired. Within a few hours we knew more about the takeover candidate than the bidder did. Honestly, we knew more than some investment bankers did.

Decision-making with the leading edge.

"Then we started getting the corporate insider trading data," Lynch continues. "It showed us some things that influenced a major deal.



Al Lynch
Director of Planning and Research, JCPenney Co.



Walt Casey
Vice President Corp. Communications, ConAgra, Inc.



James Posner
President James Posner Assoc. Ltd.

"This service really makes a difference in the day-to-day running of your business. It can pay for itself very quickly."

Surprisingly easy.

All you need to access the service is a PC and modem. Using the service is "No problem," according to Posner.

"There's no difficulty using the service. I ask for pointed, specific information and get exactly what I need. It's much easier than manual research."

Walt Casey agrees. "Dow Jones News/Retrieval is simple enough for anyone who's at all comfortable with computers to use it effectively from their very first day online."

Making the right decision.

There are hundreds of online information services, many offering business data. How can you pick the best *one*?

"It was apparent from the first step that the most useful system was Dow Jones News/Retrieval," remembers Casey. "It offers so much of the information you're looking for—from general news and stock quotes, to data on our company and industry. It was the best single source."

"I've had other services, but Dow Jones News/Retrieval has the most useful business information in the right form," says Posner. "The time I spend 'playing' on the computer makes more money for me—and for my clients."

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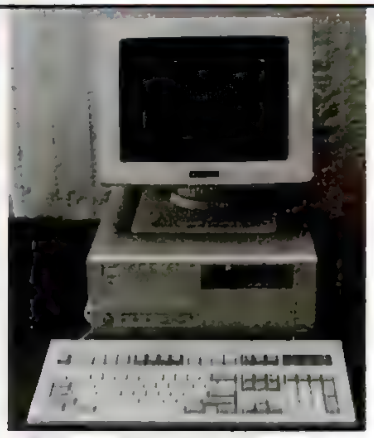
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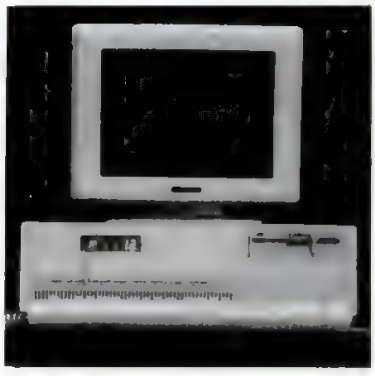
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CIRCLE 135 ON READER SERVICE CARD

■ STEPHEN MANES

COMMUNICATIONS BREAKDOWN



Some organizations have 500 386 machines, 1,000 on order, and 15 six-figure consultants to link 'em all together. But those aren't the organizations that call Manes.

It's the phone again. At this hour, all my friends are hard at work, and really important messages arrive via MCI Mail or Federal Express. Chances are it's a PR person with a mission, a stockbroker with time on his hands, or a synthesized voice offering me the rare opportunity to procure a coveted Intergalactic Gold Discount Card for only $49.97 if I call back in less than 10 minutes with the correct answer to this simple question: What glamorous blonde flips the letters on "Wheel of Fortune?"(A) Eleanor Roosevelt, (B) Helen Keller, or (C) Va——

For some reason I pick up the receiver anyway. The caller is a sincere, friendly, frazzled employee of a professional organization I belong to. She has been told I know a thing or two about computers. Do I have a minute?

This, I know all too well, will be one of those 3,600-second minutes. But what the hey: it promises to be more interesting than a conversation with a customer-service rep about the great new utility software that has just decided to turn my computer into a random-pixel generator.

"One of our East Coast members," my caller informs me, "just got back from a trip out to L.A. He came back raving about this incredible service our West Coast office has now. I think they call it an on-line bulletin board?"

"Besides the fine, clear air, what exactly was he raving about?"

"Well, the way he described it, it sounded really neat. Members can send messages to each other. I think they can even pick them up whenever they want."

"Amazing," I marvel.

"So our member suggested it'd be a great idea if we started one of these things here in New York for the East Coast."

BICYCLE MESSENGERS A paid consultant would delight in running up his billable hours by eliciting more information, lending a sympathetic ear, and setting forth a plethora of possibilities. As an *unpaid* consultant, I ask one simple question: "Why?"

"You know, so our members could exchange information and stuff."

"Apparently they have not yet been informed about an invention called the telephone."

"Yes, but he said this would let us here at the office communicate with all our members at once."

"I admit I don't read it all that often, but as I recall, we do have a monthly newsletter."



"But that has to go to press weeks before we can get it back from the printer. Then it can take days and days until the post office delivers it. This way, we could get important news out to all the members right away."

I sigh silently.

"Couldn't we?" asks the caller.

I sigh audibly. "Sure. Assuming we ever have news that's really that hot. And assuming all the members would check the bulletin board religiously. And assuming all the members have computers. And modems. Do they?"

"Oh, no. I don't think so."

"Great. How would you feel if you were a member and there was some hot news you desperately needed to know about and you never found out about it because you didn't happen to own a computer or remember to check in with the official bulletin board? Better stick to Alexander Graham Bell and bicycle messengers."

ALL-AROUND NOGOODNIK "Well, what about this idea of the members who do have computers being able to leave messages for one another?"

"Let 'em use the West Coast bulletin board. Besides, that way the members on both coasts could sort of get to know each other. You might create a new breakthrough in bicoastal relations."

"But it's a long-distance call."

"Then install an 800 number for our members."

"Oh, I don't think we could do that. That could get really expensive."

"Wait a minute. You think running

Illustration: Deb Hoeffner

■ STEPHEN MANES

your own show is going to be free?''

''Gee. I don't know.''

''Are you prepared to dedicate a computer and some phone lines to this thing? They're not exactly cheap. We're talking thousands of bucks here. And then there's the time—the hours and hours—your sysop will have to spend.''

''The syswhat?''

''The person who runs the bulletin board.''

''Oh. I thought it'd just sort of—you know—run itself?''

''Sorry. Somebody has to set it up on the computer. Then somebody has to monitor the whole thing every day. Delete old messages. Make sure the hard disk isn't full. Keep viruses from sneaking into the system. Check to make sure people aren't posting libelous messages in public areas.''

''Libelous?''

Do you want to open the organization to a lawsuit because some member posts a message stating that Dr. X is a lying, thieving, drug-pushing mafioso, an all-around nogoodnik, and a Macintosh user?''

''That could happen?''

''Sure could. Would, if you weren't careful.''

''Gee, we never thought of that.''

''I kind of guessed.''

''Well, that's why we called you.''

''How many people in the office would be able to maintain this thing, anyway?''

''What do you mean?''

''Well, who in the office has any experience with this kind of thing?''

''Nobody, really. We're not very computerized here.''

''What kind of machines do you have in the office?''

''The accounting department has had one for years. They do the payroll on it and everything. I think it's a NEC or a DEC or something?''

''The accountants don't count. What about the rest of the office?''

''The rest of the office?''

''You know: word processing, spreadsheets.''

''We have some memory typewriters.''

I knew it all along. It's a call from Another World: the Real World, in which 386 is the price of a giant-size box of dishwasher detergent, *dBASE* is a synonym for ''corrupt,'' and Manzi is Italian dialect for ''Y'all eat up now!''

''We're thinking about buying some word processors, though,'' adds the caller. ''One of our clerks saw some really cute all-in-one models at Sears. With a typewriter and everything. What do you think?''

I think our industry ought to figure out why its message isn't getting through to a broad range of people whom it could genuinely help. I also think unpaid consultants need a new synonym for *overtime*. PC

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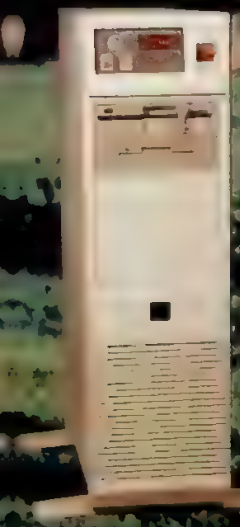
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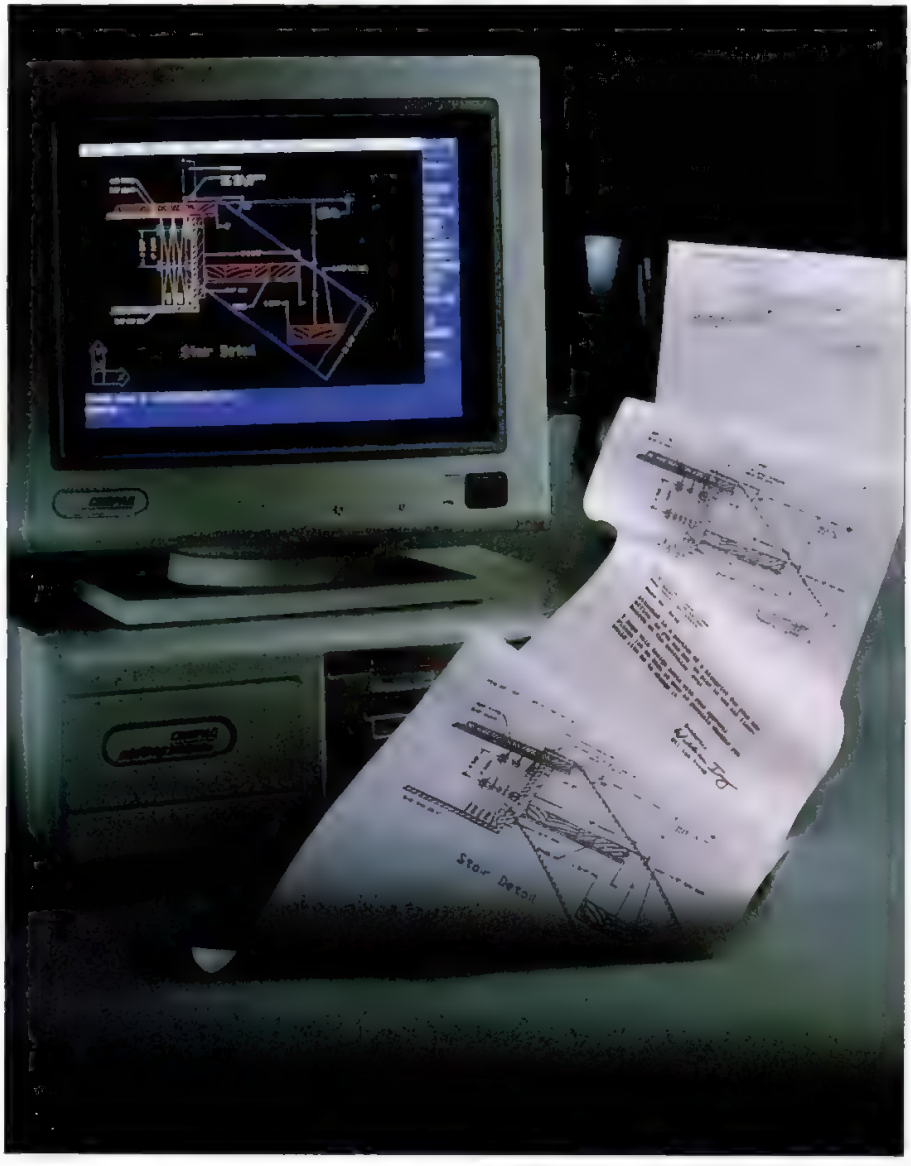
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PC *to* PAPER

FAX GROWS UP

■

Photographs: Thom O'Connor

Less than a year ago,

a fax board for a PC was a questionable investment. Today

you can find at least several

well-designed systems that transmit text and graphics—

and handle the arcane

details of data communications for you.

■

In case you haven't noticed, fax technology is coming of age—and changing the way businesses communicate.

The latest wrinkle in fax transmission is the partnership between fax and PC. Like any good partnership, this is one where both sides bring something important to the relationship. Fax technology offers a worldwide communication standard and a large installed base of fax machines with which to communicate. The PC makes it easy to manage a large phone book and multiple distribution lists. It also lets you schedule calls at inexpensive, nighttime phone rates.

As a PC user, you can look to fax boards for an alternative means of data communications. A fax board gives you a way to transmit text and graphics without having to worry about such matters as baud rates, parity, stop bits, file transfer protocols, and other arcane details. As a fax user, you can look to PC-based fax packages as a way to automate fax distribution. From either point of view, joining PC and fax promises to achieve more than either technology can offer alone.

Alas, much of the potential remains just that—potential. You can still get burned by making the wrong choice. In *PC Magazine*'s last roundup of fax boards (see "Getting the Fax," June 28, 1988), we found that many packages seemed to have been cobbled together. The typical menu system looked as if it had been added as an afterthought, with menu choices that weren't implemented and important features available only from the DOS command line.

This time around, we found some of the same problems. But we also found several well-designed packages—among them Intel's Connection CoProcessor, The Complete PC's Complete Fax/9600, Quadram's JT-Fax 9600, and Brother's IntelliFAX—that are good examples of what a fax package can be. In short, the PC-based fax package is coming into its own.

WHICH FAX IS FAX? Facsimile transmission has been around since the middle of the 19th century. Fax standards as we know them today date back to the 1960s, when the European-based CCITT (International Consultative Committee on Telephone and Telegraph) first established worldwide standards. Fax machines based on the Group 1 standard took about 6 minutes to send a single page. Group 2 protocols, established in the mid-1970s, cut transmission time in half.

Throughout the 1960s and 1970s, the number of fax machines grew slowly and steadily. However, the explosion didn't begin until the 1980s and the introduction of the Group 3 standard.

Group 3 fax is what most people mean when they talk about fax. Introduced and approved by the CCITT in the early 1980s, the Group 3 standard succeeded in making fax transmission simple, reliable, and *fast*. Group 3 machines use a 9,600-bit-per-second, half-duplex modem to transfer data on standard phone lines, and they include a data compression scheme to speed transfer further still.

Transmission time varies depending on the compressibility of a given page, but it typically ranges from 30 to 60 seconds per page. On poor lines, the fax modem will

drop back to 7,200 bps, then 4,800 bps, and then 2,400 bps. This slows down the transfer but still lets the fax get through. Some Group 3 machines can also detect a Group 2 or Group 1 machine and fall back to the earlier protocols. (Few fax boards include this feature. However, this is not an important factor for most users, since there are few Group 1 and 2 fax machines in use.)

Just as important as speed, Group 3 offered improved readability. A machine in either Group 1 or 2 had a resolution of about 100 dots per inch. Group 3 fax resolution is either 100 by 200 dpi (standard resolution) or 200 by 200 dpi (fine resolution).

With the introduction of Group 3 machines, the fax market took off. According to Alan Pyne of CAP International, a market research firm that specializes in fax issues, sales of fax machines in the U.S. have more than doubled in each of the last 4 years—with about 90,000 sold in 1985, 200,000 in 1986, 450,000 in 1987, and as many as 1 million in 1988. During the same time, the installed base of fax machines in the U.S. has gone from 200,000 to 1.9 million, and the installed base worldwide has gone from 1.2 million to 7.7 million. Sales are expected to double once again in 1989.

This explosion in the fax market has been accompanied by falling prices. As recently as early 1987, a stripped-down fax machine sold for $2,500 or more. In 1989 the least expensive machines sell for well under $1,000.

The numbers speak for themselves. Clearly the fax market has reached critical mass. The value of having fax capability has increased dramatically, simply because there are more people to talk to, while the price of that capability has gone down. As a practical matter, owners of even small businesses are beginning to find it embarrassing if they have to answer no to the question "Can you fax it to me?"

Not so incidentally, there is now a Group 4 fax standard. Group 4 fax machines can send a page in 5 to 10 seconds, with resolutions of up to 400 dots per inch. However, this group of machines requires an all-digital telephone network, which is not likely to be widely available until well into the next century, and they sport prices of $8,000 and up—mostly up.

For now and some time to come, Group 4 machines will be of interest primarily to a few large corporations that are willing to make the investment in dedicated, digital lines for in-house communications. For the rest of the world, fax communications will mean Group 3 fax.

ENTER THE PC When PC-based fax packages were introduced at $1,000 to $1,500, stripped-down fax machines were selling for $2,500 to $3,500. Many argued at the time that fax boards could serve as inexpensive substitutes for fax machines. With fax packages now in the $400 to $1,000 range and fax machines selling for under $1,000, that argument is hard to maintain.

■

Receiving a fax on a PC adds its own complications: reboot your system while a transmission is in progress, and you can lose the fax.

■

In reality, fax packages never were an inexpensive substitute for a fax machine. Start with $1,000 for a fax package, add another $1,000 or so for a scanner, and you're well into fax machine territory. What's more, since fax files are graphics files, they can quickly eat up a great deal of disk space. Realistically, you'll need 2 or 3MB of storage even for casual use; so you may need to spend a few hundred dollars for a larger hard disk. By the time you're done, you could easily buy a full-featured fax machine.

Aside from price, there is the issue of convenience. One of the driving forces behind the fax revolution is ease of use. Most fax machines are almost as easy to use as a telephone: put the paper in the fax scanner, enter the phone number, and hit the start button. Anyone can learn how to use a fax machine in about 5 minutes' time.

Compare that with faxing from your PC. First, you have to load the fax program. Then, if you start with hard copy, many packages force you to scan the image into a fax file as a separate step. Even those packages that let you scan and send in a single step will ask you to make more choices than with a fax machine.

With a typical menu system, to send a fax you might have to choose Send, designate where to send from (disk or scanner), tell the system what kind of disk file if sending from disk (for example, ASCII, *PC Paintbrush*, *Dr. Halo*, or fax format), whether to send immediately or at some specified time and date, and whether to take a phone number (or distribution list) from an on-line phone book or let you enter it from the keyboard. With all these choices to make, even the most intuitive menu structure will take some time to learn.

Receiving a fax on a PC adds its own complications. With a PC-based package that uses foreground mode, you have to load the program, wait for the fax, then typically give it a command to print the fax. For those programs that use background mode, you have to give up some precious memory and hope that the fax program doesn't conflict with any of your other programs. You may also run into such problems as losing a fax simply because you chose to reboot your system and didn't realize that there was a fax transmission in progress. Compare that to receiving on a fax machine, where all you have to do is pick up the pages as they fall out of the fax printer.

WHEN FAX MAKES SENSE Clearly, a PC-based fax package at any price is not a practical substitute for a fax machine. Yet there are two situations where fax boards make good sense. One is when your needs are so sporadic that you can probably manage without any faxing capability at all. The other, ironically, is when your needs outstrip the abilities of a fax machine.

If your faxing need is strictly occasional and is limited to receiving faxes and to sending text and graphics that you create on your computer, then a fax pack-

age—without a scanner—is all you need. Virtually all fax packages will convert and send ASCII files, and most will convert one or more popular graphics formats: typically *PC Paintbrush* and *Dr. Halo*. Some packages—such as The Complete PC's Complete Fax/9600—will even capture output meant for a printer. This procedure lets you tell your favorite program to print a file, then have the fax package convert the print output into a fax. One of the benefits of sending a graphics file by fax rather than by modem is that you can send graphics to anyone and not have to worry whether the person receiving it has the right graphics program with which to print the image.

If your needs are heavy duty, almost any fax package will let you create and manage large phone books and multiple distribution lists. Some go even further. For example, Ricoh's ImageCard is designed to be a server for a fax network. Special software lets you call from PCs that don't have fax boards and use the server to send faxes elsewhere. Other packages—notably GammaLink's GammaFax—include a rich batch language to let you program your own applications.

PC-based fax packages have some inherent advantages over fax machines. Any fax sent directly from disk will look sharper than one that has been scanned, simply because scanning degrades an image. Also, any fax printed on the paper of a computer printer has an advantage over faxes printed on the thermal paper of a reasonably priced fax machine.

One common misconception is that faxes printed on a 300-dpi laser printer will automatically look better than faxes printed on a fax machine. This is not usually true. The quality of the laser output depends almost entirely on the conversion algorithm in the fax package. In any case, as our timing tests show, receiving a fax and then printing it at even 150 dpi on a laser printer takes far longer than printing on a fax machine—or a dot matrix printer. If you get a fax package, you may want to resurrect your old dot matrix printer.

SIMILARITIES AND DIFFERENCES

The 15 packages reviewed here represent a wide range of design choices, yet these fax packages share a number of important features, particularly on the hardware side. All 15 are built around the same Rockwell chip set, ensuring an underlying compatibility with fax modem protocols. Several—including Intel's Connection CoProcessor, The Complete PC's Complete Fax/9600, and Ricoh's ImageCard—feature onboard microprocessors to allow true background operation.

Most, including the Connection CoProcessor and the Complete Fax/9600, offer a Hayes-compatible 1,200- or 2,400-bps modem either as standard equipment or as an option. And only one board, Omnium Corp.'s Omnium PC Fax System, has a maxium transmission rate of 4,800 bps; all the rest have a maximum transmission speed of 9,600 bps.

As is often the case, software varies more widely than hardware. For example, some packages force you to convert files to fax format in a separate step; others convert and send in a single step, creating the fax file automatically. Still others—notably Quadram's JT-Fax 9600 and Intel's Connection CoProcessor—minimize the need for disk space by converting to fax format during transmission without needing to create a new file.

Encouragingly, installation was not as much of a problem with this crop of packages as in the past. In many cases, reviewers had products installed and working in an hour or less, thanks to generally im-

FAX MODEM AS DATA COMMUNICATIONS MODEM

One of the more intriguing facts about 9,600-bit-per-second fax boards is that every board is built around a 9,600-bps modem. Some fax packages, like Intel PCEO's Connection CoProcessor, take advantage of this by offering a 9,600-bps file-transfer feature.

Unfortunately, you can't use the high-speed file-transfer feature unless you have the same model board on both sides of the connection. What keeps different boards from sending files to each other is that each manufacturer uses its own file-transfer protocols.

Given that the 9,600-bps modem market suffers from this same lack of standardization, fax board manufacturers have a golden opportunity. Namely, fax board modems can become the basis for a 9,600-bps standard for data communications. All that's needed is agreement on the standard.

That standard may well be coming—and sooner rather than later.

In August 1988, CAP International, a market research company that specializes in fax issues, called a meeting of fax vendors with the hope of hammering out a standard for binary file transfer. As a result of that meeting, a group was formed to help establish a standard. Last November this group became an official subgroup of the Electronic Industries Association (EIA) TR29 Facsimile Systems and Equipment committee with the function of defining the data processing protocol for fax boards.

As of this writing, the subgroup on binary file transfer had been charged with presenting a proposed standard to the TR29 group in February 1989. According to Phillip Bogosian, the chairman of the subgroup, the proposal emerging from the February meeting should be developed well enough that some manufacturers may choose to implement it even before it becomes an official EIA position. If so, we will soon be seeing fax boards that include the proposed binary-file-transfer specification.

According to Bogosian, current boards should be able to use the new standard once it is developed. For boards without processors, the protocol should be fully implemented in the software. Boards with processors will probably need firmware changes. But in any case, the new standard should not require additional hardware—though some manufacturers may choose to add more memory, for example, to gain additional buffering.—**M. David Stone**

proved installation instructions. Alas, there are still some packages that can take a full day or more to get up and running.

INTRODUCING CAS A last item worth noting is the introduction of CAS as a feature on Intel's Connection CoProcessor. CAS, the DCA/Intel Communicating Applications Specification, is a proposed standard for communications hardware and software. Given CAS hardware such as the Connection CoProcessor, any application can use CAS to add background communications and fax capabilities.

CAS allows for wide variation among programs. Typically, the communications menu for each application will be designed to look like the base program, so that a *Lotus 1-2-3* add-in will have the look and feel of *1-2-3*, while a *WordPerfect* menu will have the look and feel of *WordPerfect*. Unfortunately, the variation can extend to features and menu logic (as opposed to look and feel) as well, so that if CAS catches on, you may have to learn a different menu logic with each program, and you may have limited features available in some programs.

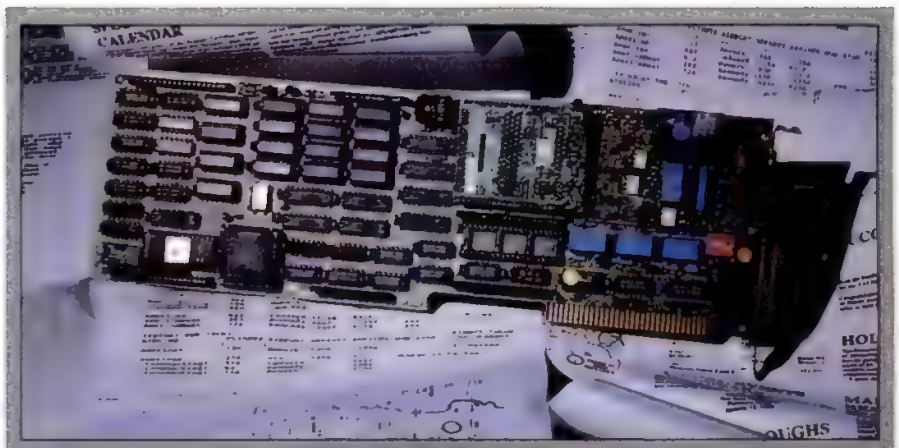
As of this writing, the impact of CAS is not clear. The idea of a standard background communications capability is attractive, but many fax packages without CAS already handle fax transmission from within any application. And even as CAS applications are being developed, so are other, competing approaches. For example, WordPerfect has just announced a new driver to let users send and receive faxes from within WordPerfect 5.0 using JT-Fax.

By all indications, we are looking at the opening moves in a drive to integrate fax capabilities into standard PC applications. The results promise to be interesting.

AMERICAN DATA TECHNOLOGY INC.

SMARTFAXplus

American Data Technology's SMARTFAXplus is the fax board for the person who needs everything. Besides having the standard fax capabilities, the software that comes with the SMARTFAXplus offers you several convenient reference resources, such as those for time zones and telephone area codes. It also boasts a full array of advanced features such as calling lists, transaction logs, and printer capture mode. The basic unit costs $799, but if you want to buy add-on modules to equip the SMARTFAXplus with a data encryption board, a scanner interface card, a modem, and more, you can spend in the neighborhood of $2,000—overkill for most applications.



Besides such advanced fax features as calling lists, transaction logs, and a printer capture mode, the software that accompanies the 9,600-bps SMARTFAXplus, a $799 full-length interface card from American Data Technology, has reference resources for time zones and telephone area codes.

The basic unit is a 9,600 bits-per-second fax board on a full-length interface card. Its accompanying software employs a combination of simple-to-use horizontal moving-bar menus for major functions and pull-down vertical menus for options.

RELIABLE BUT NOT PERFECT The SMARTFAXplus runs in the foreground, in the background, or as a TSR that takes up about 60K of memory, an improvement over some other programs that need a minimum of 140K just to sit in the background and stay awake. Our background operation error testing proved the SMARTFAXplus to be reliable but not great: you won't get into trouble by losing faxes it thought it sent, since it can recover from problems and reschedule calls. On the other hand, if a receiving computer is busy looking at an empty drive, the SMARTFAXplus can't sneak through as can some of the more robust units.

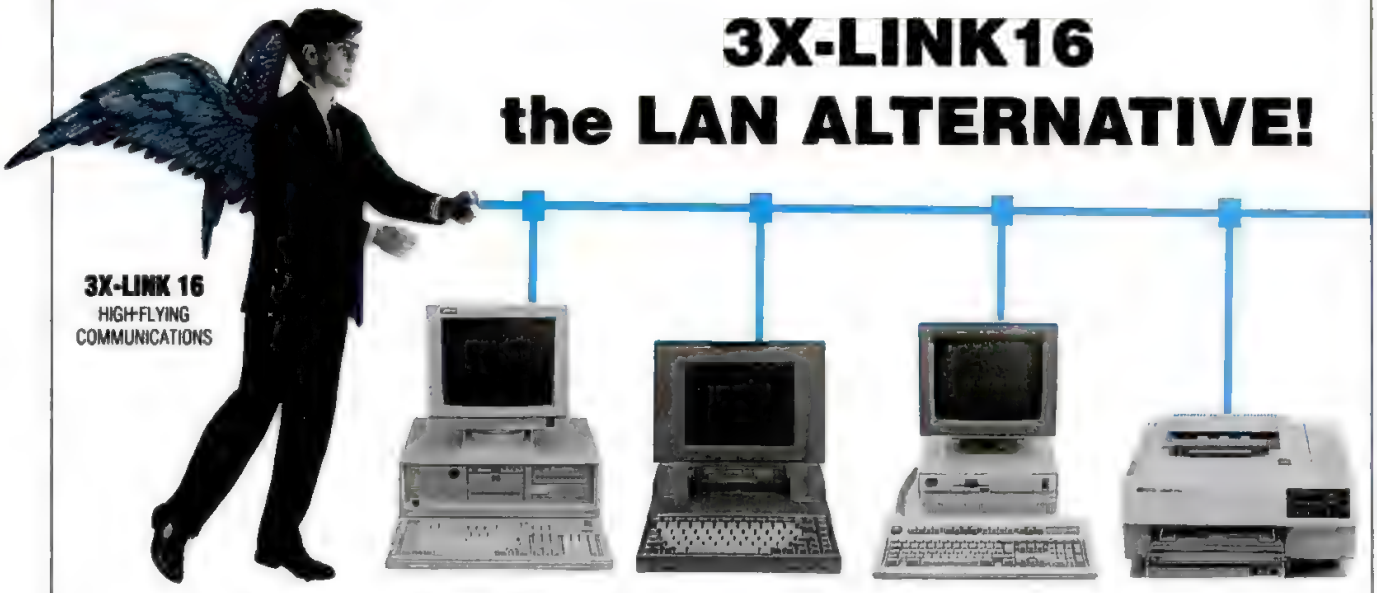
The SMARTFAXplus has calling lists, call scheduling, a printer capture mode in which it holds anything formatted for an Epson FX-80 printer, and screen capture for subsequent transmission. Unlike some other units, the SMARTFAXplus does not capture screens for immediate transmission, though it can send captured screen files later. Quite handy is a conversion utility for changing files between text, graphics, and fax formats before or after transmission. You can also convert files to fax format at the same time as transmission to save disk space.

PC MAGAZINE FACT FILE

SMARTFAXplus
American Data Technology Inc.
44 W. Bellevue Dr., #6
Pasadena, CA 91105
(818) 578-1339
List Price: $799
Requires: 640K RAM (hard disk recommended); IBM PC, XT, AT, PS/2 Model 25 or 30, or compatible; CGA, EGA, or Hercules graphics adapter; DOS 2.1 or later.
In Short: A moderately expensive 9,600-bps internal fax board system that can quickly become a very expensive system with the addition of optional modules. The SMARTFAXplus software uses horizontal sliding-bar and pull-down menus and is easy to operate. Includes a world map with time zones and an area code database.

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3X-LINK16
the LAN ALTERNATIVE!

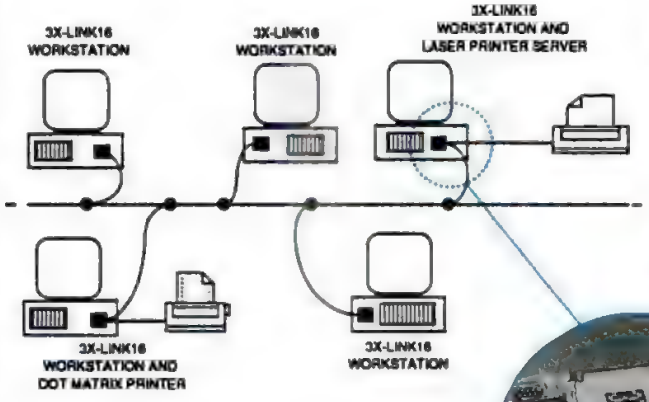


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What's more, our built-in E-Mail feature lets you send messages in background mode,no extra E-Mail software required.

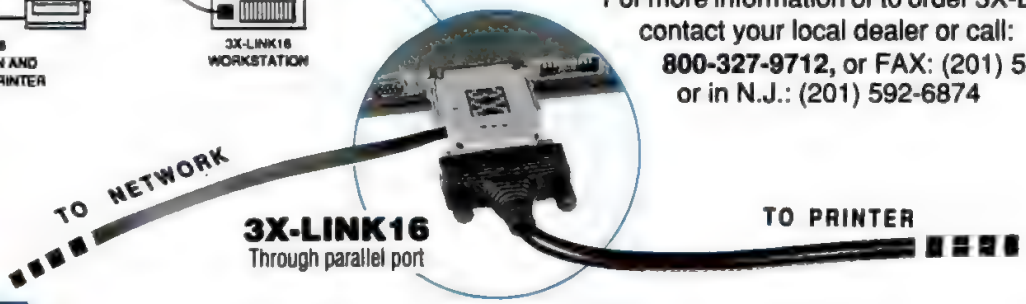
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Phone: (800) 327-9712

CIRCLE 234 ON READER SERVICE CARD

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circuitry exceeds strict UL and IEEE specifications. Its noise filtering circuitry protects against EMI and RFI. Its two protected phone jacks defend your modem (and PC) against surges and spikes on the phone line. Its nameplate dissipates harmful static whenever you touch it. And its unique low voltage indicator alerts you when your power level drops below the safety of 104 Volts, to warn you of dangerous low power conditions.

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CIRCLE 533 ON READER SERVICE CARD

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SMARTFAXplus reads and writes *PC-Paintbrush*, *Dr. Halo*, and TIFF graphics files. Once you receive a file, SMARTFAXplus has only limited editing features, including cutting and pasting, file merging, and the ability to add text to a file. It also has normal- and high-resolution modes, normal and compressed fonts, and gray scaling support, which cannot be turned off.

According to the vendor, the SMARTFAXplus works with all Group 3 fax machines; we had no trouble sending or receiving faxes with any of the fax machines used in testing. In addition, the system works with Princeton LS-300A, Hewlett-Packard ScanJet, Canon IX-12, and Pentax scanners, and with IBM and Epson dot matrix and HP LaserJet printers and their compatibles as well as the Canon laser printer.

■

While the SMARTFAXplus is a fancy unit that's easy to like, it didn't fare too well on the PC Labs aspect ratio tests.

■

In our tests the SMARTFAXplus was moderately fast. As is typical, it took about twice as long to receive and print a file with the SMARTFAXplus as it does to get hard copy from a fax machine.

The SMARTFAXplus didn't fare too well on the PC Labs aspect ratio tests. While you can easily adjust page size both vertically and horizontally to correct for skewed aspect ratios, when we used the default settings the resulting test grid came out about twice as long as the original, and text came through looking as if it had been squashed. These problems can be taken care of by adjusting the page size, but the fact remains that the SMARTFAXplus was noticeably off on this particular test.

Despite this, it's easy to like the SMARTFAXplus; it's a fancy unit with a lot of features and an attractive interface. You just have to make sure that you can resist the temptation to load up on all but the most essential extras.—**Bruce Brown**

AT&T

AT&T Fax Connection

AT&T's fax board has the sleek, luxurious look that goes with fine materials and careful workmanship. But the software that comes with the full-length $995 Fax Connection board, while straightforward and reliable, is a lot less sleek-looking. It works entirely from the DOS command line, using almost no menus except during installation.

The Fax Connection's software drives a scanner, maintains a useful and readable log, lets you view incoming faxes reasonably quickly, and lets you send multiple files to one or more destinations. The software runs in foreground mode only, forcing you to convert your computer temporarily into a fax machine whenever you send or receive. Many users will need little more.

However, a couple of paragraphs buried in an addendum to the manual suggest that you may want to buy AT&T's separate *PagePower* software package to increase the powers of the Fax Connection board. *PagePower* is a $295 software behemoth that you can buy along with the board for $200 if you know enough to order them together. PC Labs tested the board with the software that comes with it, and we also took a long look at *PagePower*.

The native software installs in a few seconds. You can choose to work with an Epson, HP, or AT&T printer, and you can choose the size of the buffer used for incoming faxes (the larger the better). You also select the resolution you want for sending and receiving and pick a hotkey for a screen capture program. Anyone familiar with DOS command line syntax can start running the program after spending a few more seconds with the manual.

SENDING AND RECEIVING When you run the sending program, you use the DOS command line to specify the names of the files you want to send, the resolution, the phone number (or file with a list of numbers), or an optional switch that lets you start sending manually during a voice call. The software automatically sends ASCII files without preconversion, but can't convert or send any graphics formats other than those created by a scanner. However, you can merge the first page of text with a graphic logo or letterhead file created with the scanner.



The full-length 9,600-bps $995 Fax Connection board from AT&T comes with software that drives a scanner, maintains a useful and readable log, lets you view incoming faxes reasonably quickly, and lets you send multiple files to one or more destinations. The software runs in foreground mode only, forcing you to convert your computer temporarily into a fax machine whenever you send or receive.

Fax Systems: Summary of Features

(Products listed in ascending price order)

FAX FEATURES	Microlink Fax LC96 $499	FaxMail 96 $599	Omnium PC Fax System $599	Pamirs FA10 $645	GammaFax $695	MicroFax $695
Standard Group 3 speeds (bps)	9,600, 7,200, 4,800, 2,400	9,600, 7,200, 4,800, 2,400	4,800, 2,400, 1,200	9,600, 7,200, 4,800, 2,400	9,600, 7,200, 4,800, 2,400	9,600, 7,200, 4,800, 2,400
High-resolution mode	○	●	●	●	●	●
Supports gray scale or dithering	○	●	●	●	○	●
Transmits compressed fonts	○	●	○	●	●	●
Can include document header	●	●	○	●	○	●
Maximum number of pages transmitted	999	360	Unlimited	Unlimited	Unlimited	Unlimited
Does polling	○	●	○	●	●	●
Runs in background mode	●	●	○	○	●	●
TRANSMISSION FEATURES						
Transmits directly from scanner	●	●	○	●	●	●
Sends current screen in response to PrtSc	○	○	○	○	○	●
Saves current screen to file	○	○	○	○	○	●
Directs printer text output to fax	○	●	○	○	○	○
Directs printer graphics output to fax	○	●	○	○	○	○
Saves printer text output to file	○	●	○	○	○	○
Saves printer graphics output to file	○	●	○	○	○	○
Converts to	*Dr. Halo, GEM Paint, Microsoft Paint*, .PCX, TIFF	ASCII, .PCX	ASCII, *Dr. Halo*, .PCX	.PCX	ASCII, .CUT, .PCX, TIFF	GEM, .IMG, *PC Paint*, .PCX, TIFF
Converts from	*Dr. Halo, GEM Paint, Microsoft Paint*, .PCX	ASCII, .PCX	ASCII, *Dr. Halo*, .PCX	ASCII, *Dr. Halo*, .PCX, *Windows Paint*	ASCII, .CUT, .PCX, TIFF	GEM, .IMG, *PC Paint*, .PCX, TIFF
Does automatic erasing after transmission	●	●	○	●	○	○
OTHER						
Compatible scanners						
Canon Image Scanner	● (IX-12)	● (IX-12)	○	● (IX-8, IX-12)	● (IX-12)	● (IX-12)
DEST	○	○	○	○	○	○
Hewlett-Packard ScanJet	●	●	○	○	●	●
Microtek	○	○	○	● (MS-200C, MS-300C)	○	● (MS-300A)
Panasonic	○	○	○	○	○	● (FX-RS505)
Princeton Graphic Systems	○	○	○	○	○	● (LS-300A)
Other	Mitsumi DFI hand scanner	Brook Trout IX-12	None	Digitech hand scanner	None	AT&T Overview, Datacopy, IBM 3117, Ricoh, ShapeScan SS-240
Generates letterhead	○	●	○	●	●	○
Generates custom fonts	○	●	○	○	●	○
Includes standard modem	○	○	○	○	○	●

—Editor's Choice ●—Yes ○—No N/A—Not applicable: this product converts files during transmission without creating a fax format file.

The Complete Fax/9600 $699	JT-Fax 9600 $795	SMARTFAXplus $799	AT&T Fax Connection $995	Connection CoProcessor $995	Facsimile Pac $995	Brother IntelliFAX $999	Panasonic FX-BM89+ Fax Partner $999	ImageCard $1,175
9,600, 7,200, 4,800, 2,400	9,600, 7,200, 4,800, 2,400	9,600, 7,200, 4,800, 2,400	9,600, 7,200, 4,800, 2,400	9,600, 7,200, 4,800, 2,400	9,600, 7,200, 4,800, 2,400	9,600, 7,200, 4,800, 2,400	9,600, 7,200, 4,800, 2,400	9,600, 7,200, 4,800, 2,400
●	●	●	●	●	○	●	●	●
●	●	●	●	●	●	●	●	○
●	●	●	● (landscape only)	●	○	●	●	●
●	●	●	●	●	○	●	●	●
999	Unlimited	Unlimited	Unlimited	Unlimited	999	Unlimited	Unlimited	999
●	○	○	○	●	○	○	●	●
●	●	●	○	●	●	●	●	●
●	●	●	○	○	●	●	●	○
●	●	○	●	○	●	●	●	○
●	●	●	●	○	○	●	●	○
●	●	●	○	○	●	●	○	○
●	○	●	○	○	●	○	○	○
●	●	●	○	○	●	●	○	○
●	○	●	○	○	●	○	○	○
.CUT, .MSP, .PCX, TIFF	.PCX	*Dr. Halo*, .PCX, TIFF	ASCII	.PCX, .PIC	ASCII, *Dr. Halo*, .PCX	.PCX	ASCII, .PCX	.CUT, .PCX
.CUT, .MSP, .PCX	.PCX	*Dr. Halo*, .PCX, TIFF	ASCII	.PCX, .PIC	ASCII, *Dr. Halo*, .PCX	.PCX	ASCII, .PCX	.CUT, .PCX
○	○	○	○	N/A	●	○	○	○
● (IX-12)	● (IX-12)	● (IX-12)	○	● (IX-12)	○	● (IX-12)	● (IX-12)	○
● (All)	○	○	○	○	● (PC Scan 1000 and 2000 series)	○	○	○
●	●	●	○	●	○	●	●	○
● (All)	○	○	○	● (MS-300A)	○	○	● (MS-300A)	○
○	○	○	○	● (FX-RS505)	○	○	● (FX-RS505, FX-RS506)	○
○	● (All)	● (LS-300A)	○	○	○	● (LS-300A)	○	○
None	Chinon	Pentax SB-A4301, ShapeScan	AT&T SC-60	Datacopy 220, 230	None	Brother Intelli-SCAN; Chinon N205 and Desk-Scan 2000	None	None
○	●	●	●	○	○	●	○	○
●	○	○	○	○	○	○	○	●
○	○	○	○	○	○	●	○	○



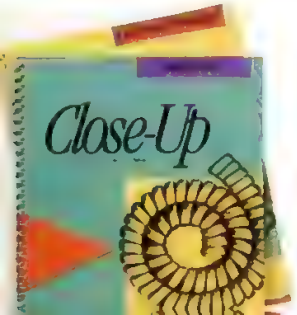
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PC MAGAZINE FACT FILE

AT&T Fax Connection
AT&T
1 Speedwell Ave.
Morristown, NJ 07920
(800) 247-1212
List Price: $995; *PagePower* software, $295 ($200 if bundled with board).
Requires: 512K RAM; hard disk; CGA, EGA, VGA, or Hercules monochrome graphics adapter (color with *PagePower* software); DOS 2.1 or later (DOS 3.0 or later required with *PagePower* software).
In Short: Excellent hardware that can't decide what kind of software it wants. The software supplied handles basic functions from the DOS command line; the optional *PagePower* software offers advanced functions in a more convoluted style.

CIRCLE 397 ON READER SERVICE CARD

A separate landscape-mode sending program sends ASCII files in pages of 132 columns by 66 lines. Another program drives the AT&T SC-60 scanner and creates files in fax format that you then send with the sending program. And a screen grabber is available to capture a text or graphics screen and convert it into a fax format. You have the option of converting a white-on-black screen into a more readable black-on-white.

Receiving is just as straightforward. You can set the board to wait for a transmission or to receive on command. A simple viewer gives you no control over scale and probably won't show you enough of the page to make the program worthwhile, but at least you can flip the image if it came in upside down. You'll use the print program instead of the viewer in most cases. The software sends and prints at generally impressive speeds.

IGNORE AND PAY EXTRA? AT&T says that it limits the software packed with the board to these simple functions so that VARs can devise their own software packages for customers. AT&T suggests that themselves, AT&T seems to be charging extra for capabilities that other vendors supply with the board.

PagePower has capabilities to spare. AT&T wrote this impressive integrated set of fax, scan, draw, and communications programs to run under *Microsoft Windows* (a runtime version is supplied with the program), and *Windows*'s graphics interface is ideal when viewing or editing a fax file. And the mouse speeds things up when you select files from a menu. *Windows*, however, is less than ideal when you perform character-based functions like editing a phone list or typing in a time for a transmission.

The fax software in *PagePower* works with a resident scheduler, so you don't have to stay in *Windows* to send or receive. It can use the TIFF format to exchange files with its built-in draw program, and you can use the *Windows* clipboard to exchange graphics from other formats. Strangely, the draw program locked up the computer when I used it with a copy of *Windows* installed for a Hercules board, although it worked perfectly with VGA and EGA cards.

POWERFUL BUT REGRESSIVE Powerful as it is, *PagePower* takes a step backward from the software included with the Fax Connection board in some respects. You have to preconvert ASCII files into fax format before sending them—a step that the board's less sophisticated software makes unnecessary. Furthermore, all functions now require you to tumble down a cascade of menus before you can complete them, rather than working from the DOS command line. The only way you can send faxes without using *PagePower* is by using a command-line program that drives a scanner but won't work with disk files.

We tried to load both *PagePower* and the software supplied with the board on the same machine, but the two did not coexist. The ideal software for AT&T's superb hardware might be neither the current ver-

BROOK TROUT TECHNOLOGY INC.

FaxMail 96

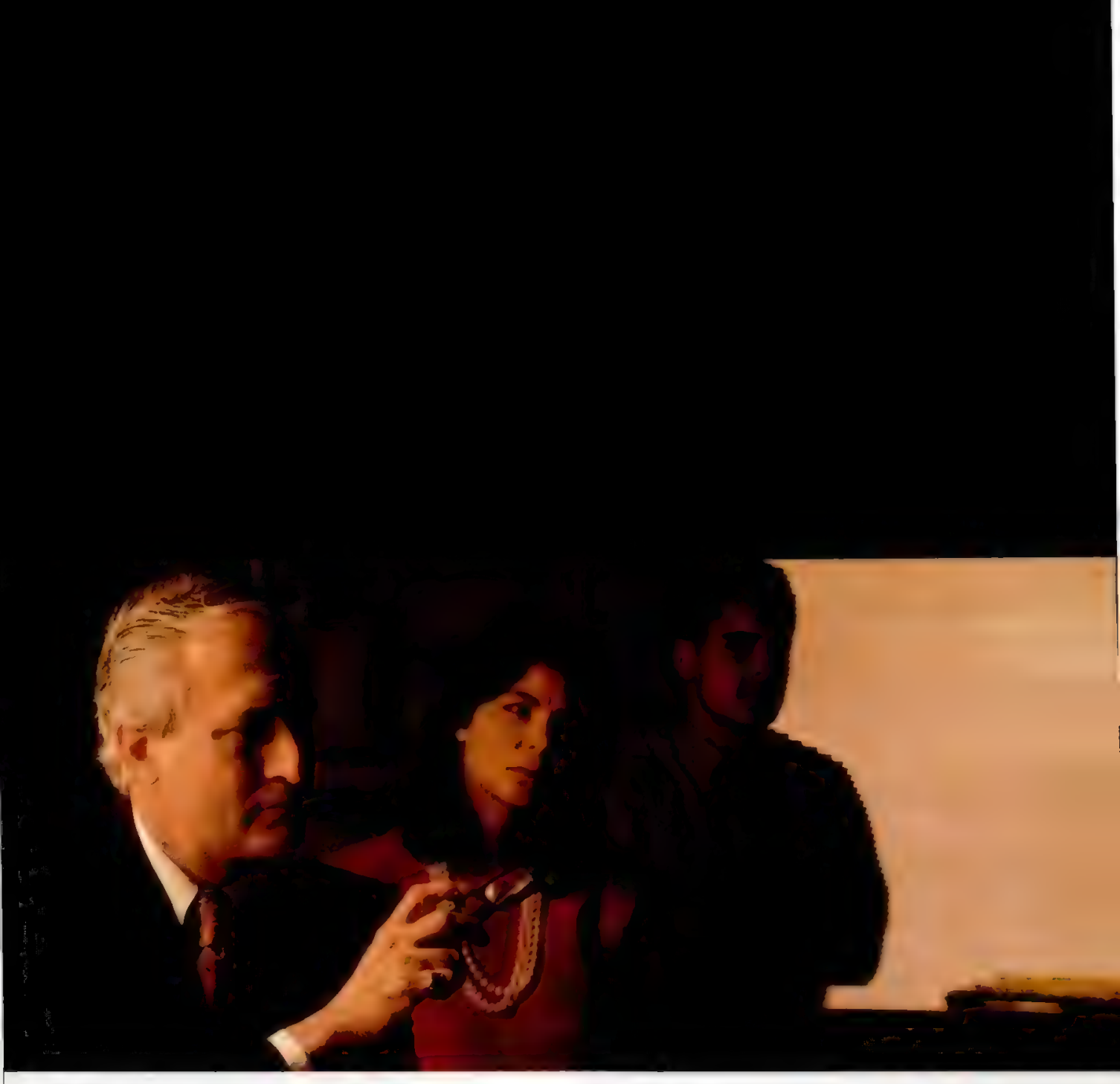
What makes Brook Trout's $599 FaxMail 96 such a good catch? Well, Brook Trout offers two user interfaces: an attractive menu-driven system for those who need the hand-holding, and a sophisticated command-driven interface for those interested in automating fax transmission. It also incorporates a proprietary print capture utility that lets you redirect any LPT1 output from any application to a Group 3 fax format file. Essentially, this means that if you can print it, you can send it.

That's not all. Brook Trout offers the supporting tools every fax board should include. There's a built-in mini–word processor, powerful enough to send text messages without having to darken the directories of your word processor. There's a graphics editor that handles simple cut, paste, and view functions. And finally, Brook Trout has a useful facility for adding existing signature and letterhead files to the body of your text.

EFFORTLESS INSTALLATION The Brook Trout system includes a full-length board, three disks of software, and a phone cable. Software and hardware installation is effortless. The board comes configured with a certain port address and interrupt settings, but these can be changed easily through DIP switch and jumper settings.

PC MAGAZINE FACT FILE

FaxMail 96
Brook Trout Technology Inc.
110 Cedar St.
Wellesley Hills, MA 02181
(617) 235-3026
List Price: $599
Requires: 256K RAM (hard disk recommended for storing images); CGA, EGA, or Hercules graphics adapters; DOS 2.0 or later.
In Short: A fax package that includes all the tools of the trade: both a menu-driven and a



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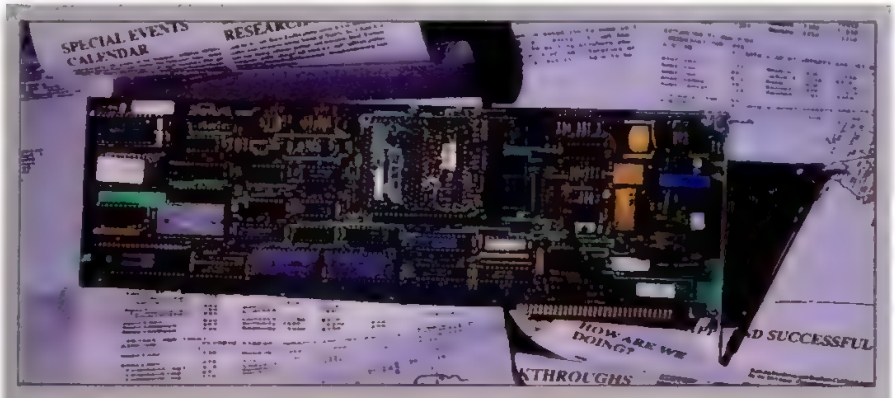
CIRCLE 263 ON READER SERVICE CARD

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The $599 Brook Trout FaxMail 96 system includes a full-length 9,600-bps board, three disks of software, and a phone cable. The board comes configured with a certain port address and interrupt settings, but these can be changed easily through DIP switch and jumper settings.

You can transparently access the software's executable programs via the menu system, or you can run each, with a series of arguments, from the DOS command line.

Brook Trout relies on a RAM-resident scheduler module to send and receive faxes. If the resident portion, RESXMIT .EXE, is not loaded, you can still print a fax message or view the activity log, but you cannot send or receive messages. Running in the background, the 40K resident scheduler remains in memory; when running in the foreground, it is invoked and then disabled.

ASCII, *PC Paintbrush*, and print capture files can either be converted before transmission or be converted and sent in one fell swoop. When we scanned *PC Paintbrush* files for transmission, all was fine. However, when we used existing *PC Paintbrush* files for transmission in fine resolution, they were elongated to twice their size. You can remedy any aspect ratio problem by using Brook Trout's graphic editor software, issuing a command-line argument to adjust the on-screen or printed size. And according to Brook Trout's technical support staff, using the vendor's print capture utility will also yield more consistent results.

MENUS EASE THE WAY Detailed menu selections make routine fax transmissions a pleasure. Main menu selections are augmented with pop-up menu boxes. Using the send menu, for example, you can specify a delayed transmission or use a phone file to insert a frequently dialed number. You can attach a previously created letterhead or signature through the menu selections. You can receive a fax automatically in the background, where every file is logged in as FAX00*.301, or you can choose to receive manually and enter a filename of choice.

The only confusing aspect of using the menus is their extensive use of Journals. Within the submenus you can access three different Journal commands; each offers a different type of activity summary.

Leaving the menus is a different story, since the documentation is particularly sparse when it comes to explaining the command line arguments. For example, the software's ability to do dithering was undocumented, the printer scaling argument was wrongly documented, and the creation of a distribution list was poorly documented.

MONITORING TRANSMISSIONS Feedback is sent to the user during transmission, and reception is top caliber. A pop-up status box lets you monitor the messaging process, informing you when your machine is dialing or waiting for an answer, when a ring is detected, and when handshaking is going on. You can also view the transmission packet by packet and can watch as your reception is verified.

The full-screen text editor, Write, while by no means a full-featured word processor, is a useful feature. It uses a *WordStar*-like command system, handles 128K files and even includes split-screen editing. It also serves as a tool to create ASCII files for maintaining distribution lists.

The spartan command-driven graphics editor, misnamed Supershow (it should be called Minishow), lets you view, scale, cut, paste, and flip a graphics image. Although this graphics editor won't let you modify or manipulate an image to the extent that *PC Paintbrush* will, it has most of the features that most users will need most of the time.

The Brook Trout FaxMail 96 is a complete package supported by a top-notch technical staff. That became apparent during testing, when we began to question the Group 3 compatibility of our remote fax machine, a Canon Faxphone 20. Brook Trout ran a debug on a transmission it sent to the Faxphone and helped us pinpoint the incompatibility. The vendor can also handle customer requests for some unusual fonts (such as Icelandic and Hebrew) and will even create letterhead and signature files for those customers without scanners. This review caught the company between documentation upgrades, so we worked with an unfinished document. But even so, it's safe to say that Brook Trout is a good catch.—**Robin Raskin**

BROTHER INTERNATIONAL CORP.

Brother IntelliFAX

The $999 Brother IntelliFAX board is largely the same as the $795 Quadram JT-Fax 9600. That's because Brother International Corp. and Quadram's Asher Fax Products Division cooperate in the development of fax hardware and software. So how can you tell them apart—other than by price? Well, for one thing, although there is no difference in their fax-oriented features and functions, the IntelliFAX and the JT-Fax 9600 are distinguishable by their differing firmware and menu structures. Beyond that, the ⅔-length 9,600-bps IntelliFAX comes with one standard combination that the JT-Fax 9600 doesn't: a 1,200-bps Hayes-compatible modem and *Mirror II*, a *Crosstalk*-like communications package.

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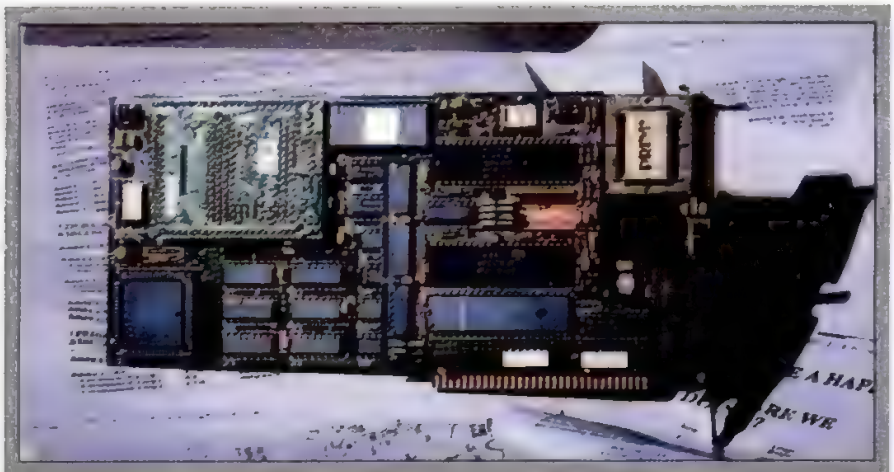
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CIRCLE 198 ON READER SERVICE CARD

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The $999 Brother IntelliFAX board is largely the same as the $795 Quadram JT-Fax 9600, but the two are distinguishable by their differing firmware and menu structures. Beyond that, the ⅔-length 9,600-bps IntelliFAX comes with one standard combination that the JT-Fax 9600 doesn't: a 1,200-bps Hayes-compatible modem and Mirror II, *a* Crosstalk*-like communications package.*

PC MAGAZINE FACT FILE

Brother IntelliFAX
Brother International Corp.
8 Corporate Pl.
Piscataway, NJ 08855
(201) 981-0300
List Price: $999
Requires: 640K RAM; DOS 2.1 or later.
In Short: Functionally similar to (and $200 more than) Quadram's JT-Fax 9600 in terms of fax functionality, the IntelliFAX system includes a 1,200-bps Hayes-compatible modem with communications software and also uses a slightly better menu structure. It's worth the extra money only if you need a modem and can settle for a 1,200-bps unit.

CIRCLE 309 ON READER SERVICE CARD

Of course, you can spend an additional $200 on an optional modem for the JT-Fax 9600, but currently you won't get any software to go with it. If you already have a modem, there's no need to spend the extra $200 in either case. And even if you do need a modem, you may not want to settle for a 1,200-bps model. Still, if you plan to use a modem only occasionally and don't have a pressing need for higher speed, the one that comes with the IntelliFAX will do the job—and won't take up an extra slot in your PC.

WORK-ALIKES There's no significant difference between the IntelliFAX's and JT-Fax 9600's performance: hard-copy output and transmission times weren't much different. For example, sending our ASCII test file directly from one PC to another took 84 seconds on the IntelliFAX and 80 seconds on the JT. Both units printed the received fax in 92 seconds.

The IntelliFAX also shares the JT-Fax 9600's foreground, background, and TSR operations. Both programs can stay out of the way when sending or receiving faxes in the background, slowing down operations in other software but not bringing everything to a halt, as did the original JT-Fax. While you can force the program to preconvert files to fax format before transmission, usually conversion takes place at the time of transmission, saving disk space.

The boards dealt identically with our error-handling tests, preventing us from sending a fax to a computer that was unsuccessfully trying to log on to an empty disk drive or that was paused with a Ctrl-S keystroke combination, and allowing us to send a fax to a computer while it was printing. Both the IntelliFAX and the JT-Fax 9600 also reacted well when we rebooted the computer while it was receiving a fax; in each case the call was automatically rescheduled by the sender.

The IntelliFAX has the same impressive list of features as the JT-Fax 9600, such as transaction logs, calling groups, printer capture, screen capture, the ability to incorporate header and signature files, normal and fine resolution, normal and compressed type, and gray scaling.

BETTER MENU STRUCTURE While there's no fax operation that you can do with the Brother IntelliFAX that you can't do with the Quadram JT-Fax 9600, the IntelliFAX's menu structure is slightly better. Making this distinction is a bit like splitting hairs, since the JT-Fax's menus are well organized and self-explanatory. The difference between the two implementations is that the IntelliFAX uses a horizontal-moving-bar menu for major functions with pull-down menus for options, while the JT's menus start with a vertical menu and then use overlapping vertical pop-ups. Both work well, but the IntelliFAX has the edge on clarity.

■

Overall, the IntelliFAX is a fine unit with a great array of features.

■

The IntelliFAX supports the same printers as the JT-Fax, which means most dot matrix printers (notably those that are IBM or Epson compatible) and the HP and Brother laser printers and compatibles. Supported scanners include units by Brother, Canon, Chinon, Princeton Graphics Systems, and Hewlett-Packard. The IntelliFAX also works with virtually all Group 3 fax machines.

Overall, the Brother IntelliFAX is a fine unit. It's easy to install and use, performs very well, and has a great array of features and functions. If you don't need a modem, you might want to look at the JT-Fax 9600 instead, since you'll get the same functions for $200 less. But if you do need a 1,200-bps modem and don't want to give up a slot, this is the board to consider.
—Bruce Brown



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Specifications	
CPU	80286-16
RAM	1-8 MB
Graphics	VGA+
PIO	1
SIO	2
Exp. slots	6
Hard disk	0/40/100 MB



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When reliability is a decisive factor

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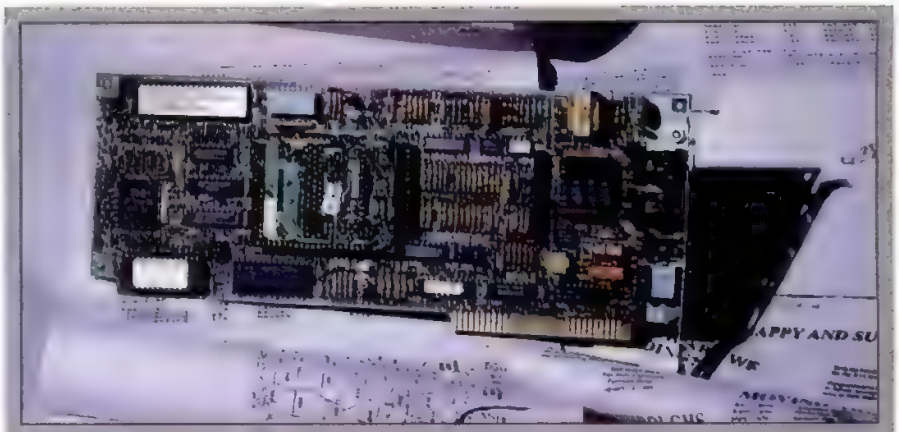
CIRCLE 335 ON READER SERVICE CARD

THE COMPLETE PC

The Complete Fax/9600

The Complete Fax/9600, or CFAX, is a prime example of what a PC-based fax package ought to be but too often isn't: almost as simple to use as a fax machine, but filled with features that require a computer. Even at $699 (or $399 for the 4,800-bps version), that package almost qualifies as a bargain.

By any measure, CFAX is strong on features. A partial list includes background operation; the ability to capture Epson FX text and graphics printer output from an application program and send it as a fax; the ability to convert files from *PC Paintbrush Plus, Dr. Halo,* and *Windows Paint* format; the ability to schedule fax transmissions and create distribution lists; and the ability to transfer binary files at 9,600 bps with another CFAX system. Of special note is a memo feature that lets you create and fax a short note completely within the fax program.



The $699 Complete Fax/9600 allows background operation. It can also capture Epson FX text and graphics printer output from an application program and send it as a fax; convert files from PC-Paintbrush Plus, Dr. Halo, *and* Windows Paint *formats; schedule fax transmissions and create distribution lists; and transfer binary files at 9,600 bps with another ¾-length Complete Fax/9600 system.*

DOING IT YOUR WAY At least as important as the sheer number of features is that CFAX often offers more than one way to handle a given function. For example, you can scan a full-page image and send it in a single step, or you can convert it as a separate step from sending. If you scan the image as a separate step, you can designate resolution, image type (line drawing or photograph), and dithering scheme (for gray-scale images).

Very much on the plus side, CFAX offers a menu structure that makes most features easy to find when you need them and easy to ignore when you don't. With few exceptions, the program unfolds naturally, presenting appropriate choices at the right time.

For example, suppose you want to fax an ASCII file. You have only to pick Send FAXes from the first-level menu, then enter the filename and phone number in the Send screen. If you can't remember the filename, you choose List, then DOS Directory, enter the name of the directory to look in, and pick the file from the list. Similarly, you can type the phone number, or you can ask to see a list of entries in the phone book and choose from that list.

Also noteworthy is a context-sensitive help feature that is informative enough so that you may never need to look at the manual. And in keeping with the rest of the package, the manual is also well organized and well written.

MAKING IT EASY Even installation is painless. The ¾-length board includes a bank of DIP switches for controlling the CFAX address and interrupts. The settings are fully covered in an appendix in the manual, though in most cases you should be able to use factory settings and simply plug in the board.

Installing the software is even easier. An install program asks a few questions about your system—including type of printer and scanner if you have one—then copies all files to the directory of your choice. If you change your hardware, you simply rerun the install program from your hard disk.

Once installed, CFAX runs as two modules. The background module answers the phone for incoming faxes, sends outgoing faxes, and, if you specify, prints faxes automatically. The foreground module allows manual control over such functions as scanning, designating files to send, and creating distribution lists. The background module also offers a pop-up screen that lets you send faxes from within virtually any program.

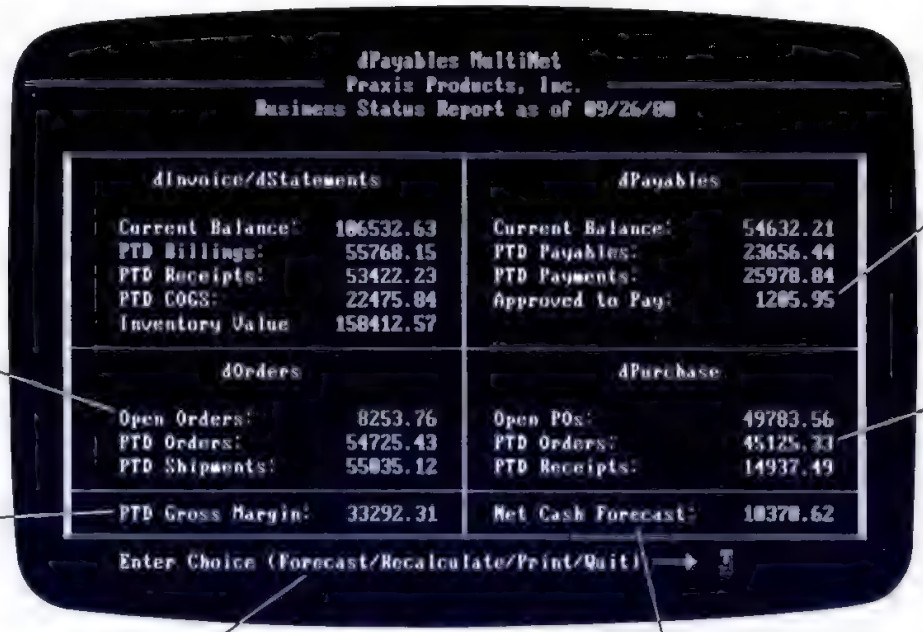
NEARLY PERFECT On PC Labs' error-handling tests, CFAX performed well, but with one exception. When we logged on to an empty floppy disk drive and then responded to the Abort, Retry, Ignore message with an "I," the system hung. A technical representative from The Complete PC said that he could not reproduce the problem, but we were able to produce it repeatedly on two different computers.

As of this writing, CFAX supports full-

PC MAGAZINE FACT FILE

The Complete Fax/9600
The Complete PC
521 Cottonwood Dr.
Milpitas, CA 95035
(408) 434-0145
List Price: $699; Hayes-compatible modem, $99.
Requires: 512K RAM; hard disk; IBM PC, XT, AT, PS/2 Model 25 or 30, or compatible; CGA, EGA, VGA, or Hercules graphics adapter; DOS 3.1 or later.
In Short: The Complete Fax/9600 manages to offer both an abundance of features and a menu structure that is easy to learn and use. Some of its more notable features are background operation, the ability to capture print output to send as a fax, and the ability to convert files from *PC Paintbrush Plus, Dr. Halo,* and *Windows Paint* formats.
CIRCLE 400 ON READER SERVICE CARD

It's 11:05am. If you had our accounting software, you'd know where your business is.



11:05
"Great, back orders are down. Now let's push those sales."

11:06
"Gross Margins look good. We can pick up sales volume with some promotions."

11:07
Let's forecast where these numbers will be at the end of the month."

11:08
"Last week's cash forecast was $4,000. We're looking much better. We can put some into CD's."

11:09
"Cash receipts are up, I can approve a few more P.O.'s."

11:10
"Purchase Orders are close to sales this month. I'll call Mary and put the brakes on any more P.O's for a while."

There's a lot to a business, and it's tough to know where all of it is, all of the time.

That is, unless you have the Database Accounting Library™ from SBT.

It offers a Business Status Report that is a complete control panel for your business. A set of instruments that gives you up-to-the-second status on what you're selling and what you're buying. On what you owe and what you're owed. Right up to the last item entered.

Which means you know virtually everything about where your business is, right now. And with a single keystroke you can project those current results to the end of the month. So you can decide when to trim and when to spend.

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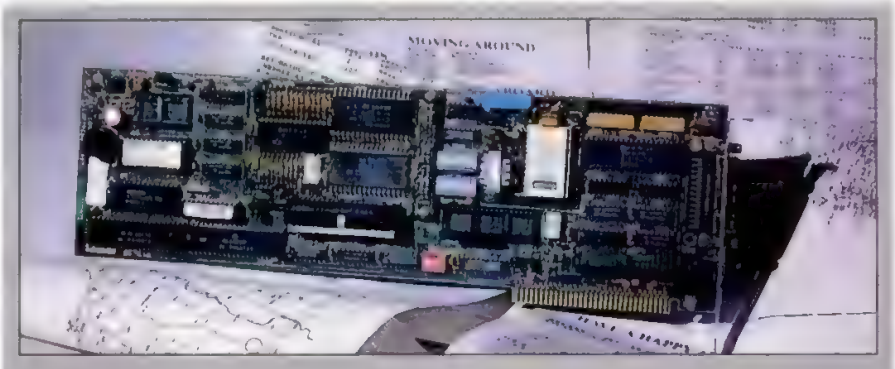
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page scanners from only four vendors: Hewlett-Packard ScanJet, Canon IX-12, Microtek (any model), and DEST (any model). In addition, the program will work with The Complete PC's Hand Scanner for scanning less than a full page. According to a Complete PC representative, by the time you read this, the company will be offering its own full-page scanner.

Scanner control is superb. In our tests using the HP ScanJet, the sample color wheel and photo retained far more detail and shading than in most other fax packages—or scanner packages for that matter. If you need to fax photos frequently, this is an important issue to consider.

As should be clear, The Complete Fax/9600 not only offers a full range of features but does so in an attractive package that is easy to learn and use. Whether your faxing needs are occasional, or you want to supplement your standalone fax machine with computer-based capabilities, the combination offered by The Complete Fax/9600 is hard to beat.

—M. David Stone



The $995 Facsimile Pack from DEST Corp. includes a full-length 9,600-bps board that has a built-in microprocessor with 8K of RAM to manage background operation. The accompanying software features a logical menu structure, excellent context-sensitive help, and lets you convert and send ASCII, Dr. Halo, *and* PC Paintbrush *files in a single step.*

DEST CORP.

Facsimile Pack

Given DEST Corp.'s well-established reputation as a manufacturer of OCR scanners and software, it was only logical that it should branch out into the fax market. The vendor's latest entry is the Facsimile Pack, a minor revision of DEST's EZ-FAX, which was reviewed in *PC Magazine*'s last roundup of fax boards (for the full text of that review, see the June 28, 1988, issue). According to a DEST representative, DEST improved the system's communications capabilities, leading to fewer transmission errors. It also dropped the price of the system from $1,495 to $995, which puts the price of this full-length board more in line with that of other boards.

The Facsimile Pack's software features a logical menu structure, excellent context-sensitive help, and the ability to convert and send ASCII, *Dr. Halo*, and *PC Paintbrush* files in a single step. The hardware includes an on-board microprocessor with 8K of RAM to manage background operation. Both software and hardware are easy to install. The factory-set DIP switch settings should work in most cases. You can plug an optional scanner like the DEST PC Scan 1000 or PC Scan 2000 directly into the board.

SCHEDULES AND PHONE BOOKS

If you need to handle a high volume of faxes, you'll be glad to know that the Facsimile Pack's scheduler and phone book have no size limit other than that imposed by the disk space that is made available to them, and both are easy to learn and use. To schedule a transmission, for example, you have only to select T for Transmit and then T, F, or S for Text, Fax file, or Scanned pages. You then enter the name of the file and the phone number by typing them in or by popping up a list, highlighting your choice, and hitting Return. You can also enter an ID name associated with a phone number.

Also helpful is the Facsimile Pack's ability to intercept printer output from any application and send it as a fax. A related feature lets you use your word processor's mail-merge function to create distribution lists by adding a command in your master document. The Facsimile Pack will read phone numbers from a data file and merge-fax the documents rather than merge-print them. You can also create distribution lists through a DOS batch file.

Any fax package can hog large amounts of disk space. Facsimile Pack has options for deleting files automatically after they have been printed, sent, or otherwise processed. Another option lets you delete files after a specified number of days. And since the program's display feature requires the creation of a separate version of the file, it's worth noting that you have the choice of creating such files automatically, manually, or not at all.

ERRORS AND SHORTCOMINGS

The Facsimile Pack could have fared better on the PC Labs error-handling tests. If you issue the Type command to a file and stop it with Ctrl-S or log on to an empty drive, the system will not acknowledge an incoming call until you restart the displaying of the file or fix the drive error. It will also let you reboot with Ctrl-Alt-Del during a

FACT FILE

Facsimile Pack
DEST Corp.
1201 Cadillac Ct.
Milpitas, CA 95035
(408) 946-7100
List Price: $995
Requires: 640K RAM (140K of which is free RAM); hard disk; IBM PC, XT, AT, PS/2 Model 30, or compatible; CGA, EGA, VGA, or Hercules graphics card; DOS 2.0 or later.
In Short: Facsimile Pack offers ease of use and the ability to merge fax documents with data files by way of your word processor. While it can handle a high volume of faxes well, it suffers from many small oversights: for example, it can't receive faxes properly sent at high resolution.

CIRCLE 401 ON READER SERVICE CARD



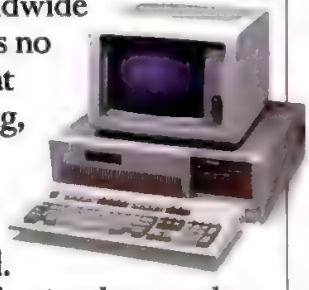
This little piggy loves MicroFax.

Because MicroFax™ from Datacopy lets you turn your PC into a fax machine for only $695. A fraction of what stand-alone machines cost but with the same sophisticated fax capabilities. And that makes MicroFax the smart solution for the fax needs of any PC owner.



SIMPLICITY

MicroFax is simple to use. It's an add-on fax board for the PC which sends and receives documents worldwide at 9600 bps no matter what you're doing, because MicroFax operates unattended. Plus it works simultaneously while other programs are running, so valuable work time is never wasted.



SOPHISTICATION

MicroFax is the first true integration of fax and PC technologies. Now, you can communicate text, graphics and computer files to and from computers and fax machines with a 1200 baud Hayes* compatible ASCII modem.

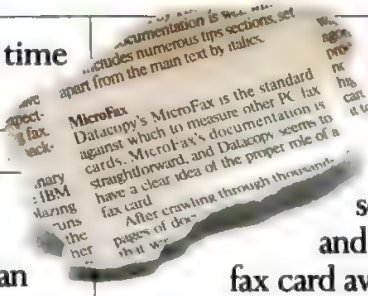
Moreover, you can transfer computer files between PCs in considerably less time at 9600 bps.

In total, that's a powerful line of communication.

BYTE MAGAZINE

And we're not the only ones who think so. Recently BYTE Magazine reviewed the Datacopy MicroFax and judged it:

"...the standard against which to measure other PC fax cards."



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CIRCLE 247 ON READER SERVICE CARD

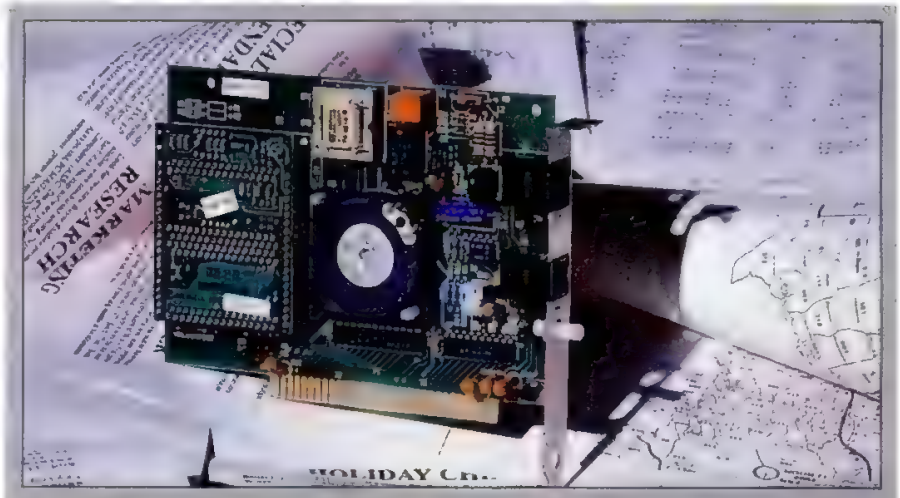
fax transmission. What's more, the manual warns you that using FORMAT, DSKCHK, or DISKCOMP during a fax transfer will result in loss of data.

The program has other shortcomings as well. For example, high-resolution transmission and conversions from fax to graphics formats are available only from the DOS prompt. Although running Facsimile Pack from DOS is a nice option—especially to let you batch activities that you run frequently—these features should also be available from the menus.

Also be aware that high-resolution mode is supported only for transmission, and only for converted graphics files. The board interprets all incoming faxes as low resolution (100 vertical lines), so that a high-resolution fax will expand to twice its original height. Other limitations are the lack of graphics features beyond a simple display function and error codes that are limited to arcane numbers (though these are thoroughly explained in the manual).

If security is an issue, you can purchase an optional encryption chip from DEST for $195. Also optional is a $129 Bell 212 1,200-bps modem that installs piggyback on the fax board. There is even a version of Facsimile Pack for use with Novell networks. A new version of the program is expected by mid-1989. According to DEST, this will offer EMS support, an unload feature to clear RAM space, and support for legal-sized printouts.

In its current version, the Facsimile Pack clearly has some limitations, and even at $995 seems a bit expensive for the features it offers. But the program is easy to set up and use, and it handles heavy fax activity well. For those with high-volume faxing needs, it is certainly worth looking at.—**John Britton**



The $695 GammaFax half-length 9,600-bps card from GammaLink comes with menu-driven software that has copious context-sensitive on-line help, plus a powerful script language for automating complex procedures. An optional CADFax *package ($395) converts* AutoCAD *and HPGL files to fax format.*

GAMMALINK
GammaFax

In its earlier incarnation, GammaLink's GammaFax was a hacker's delight but a casual user's despair. A script language let you automate a host of powerful functions, but even many simple operations had to be performed through unwieldy command strings at the DOS prompt. With its current version, the GammaFax software has entered the modern world, offering completely menu-driven operation and copious context-sensitive on-line help.

Besides the standard $695 GammaFax half-length card that we tested, GammaLink offers the $895 GammaFax Plus, which includes a second modem for standard communications functions, and the $1,095 GammaFax CP, which sports an on-board 80188 microprocessor and 256K RAM. The GammaFax CP was unavailable for testing, but according to the vendor it offers speedier performance in background mode and can convert files to fax format on the fly while transmitting them. You can also have more than one GammaFax CP operating simultaneously in a single computer. An optional *CADFax* package ($395) lets you convert *AutoCAD* and HPGL files to fax format.

SIMPLE BUT SOPHISTICATED The GammaFax software makes transmitting disk files about as simple as it can be. You just type in the filename and the phone number or select the file from an on-screen directory and choose the phone number from one of the phone books you can create. You can also tag several files and several different phone numbers to create distribution lists, which you can save for reuse later.

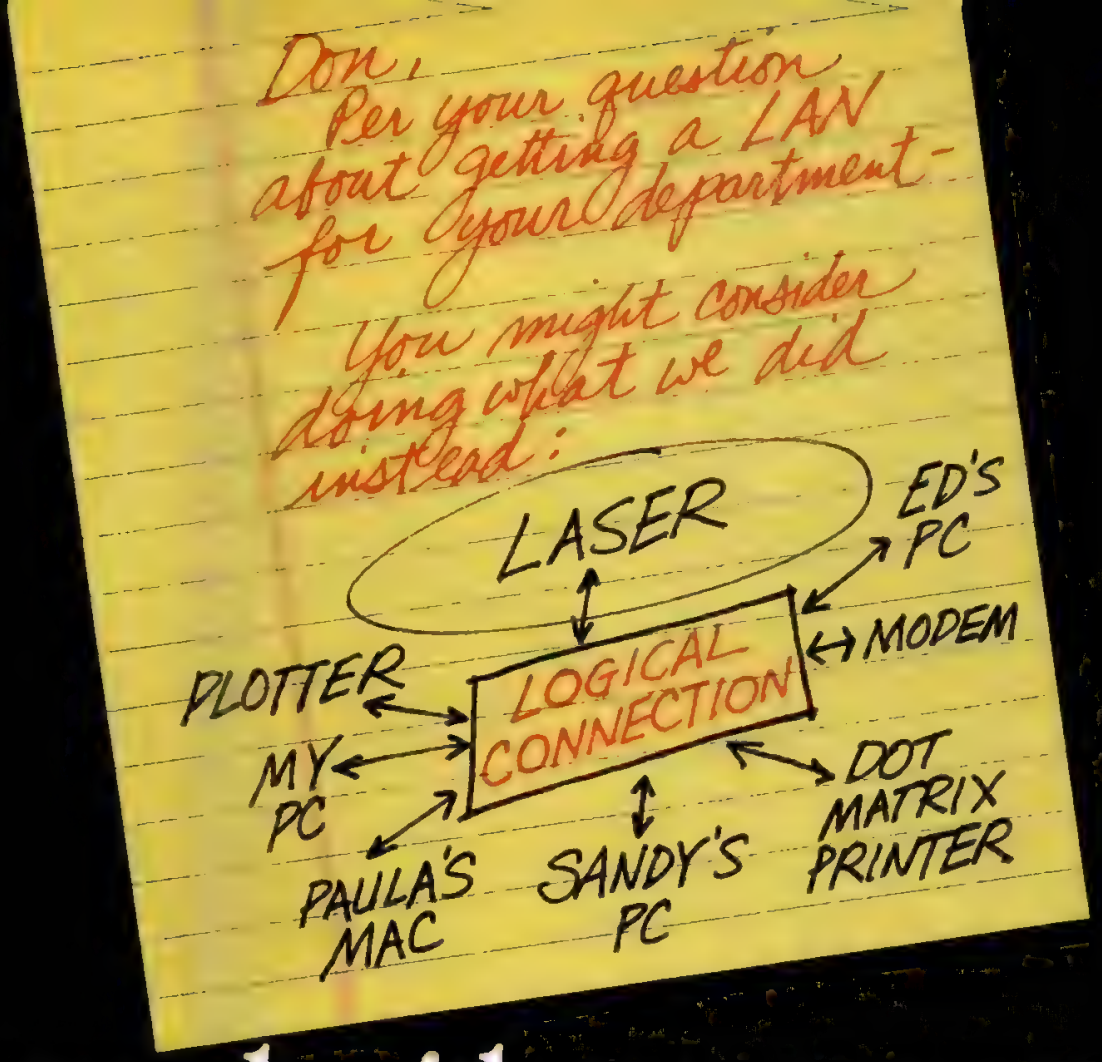
A third transmission option exemplifies the level of sophistication the GammaFax software has achieved. You can enter selection criteria for the Class and Category fields of a phone book record and then automatically broadcast files to each number that meets the criteria.

The program does everything else automatically. It determines each file's format, converts it to fax format, and then dials each number. If it can't get through, it waits a user-specified length of time and then redials the number of times you have specified beforehand. You can even opt to have it put any unsuccessfully dialed phone numbers at the end of the queue for

PC MAGAZINE FACT FILE

GammaFax
GammaLink
2452 Embarcadero Way
Palo Alto, CA 94303
(415) 856-7421
List Price: $695
Requires: 512K RAM; hard disk; IBM PC, XT, AT, PS/2, or compatible; CGA, EGA, VGA, or Hercules graphics card; DOS 3.0 or later.
In Short: GammaFax combines power and flexibility with a simple, easy-to-use menu system. It should satisfy the needs of users at all levels of sophistication.

CIRCLE 402 ON READER SERVICE CARD



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Benchmark Tests: Fax Boards

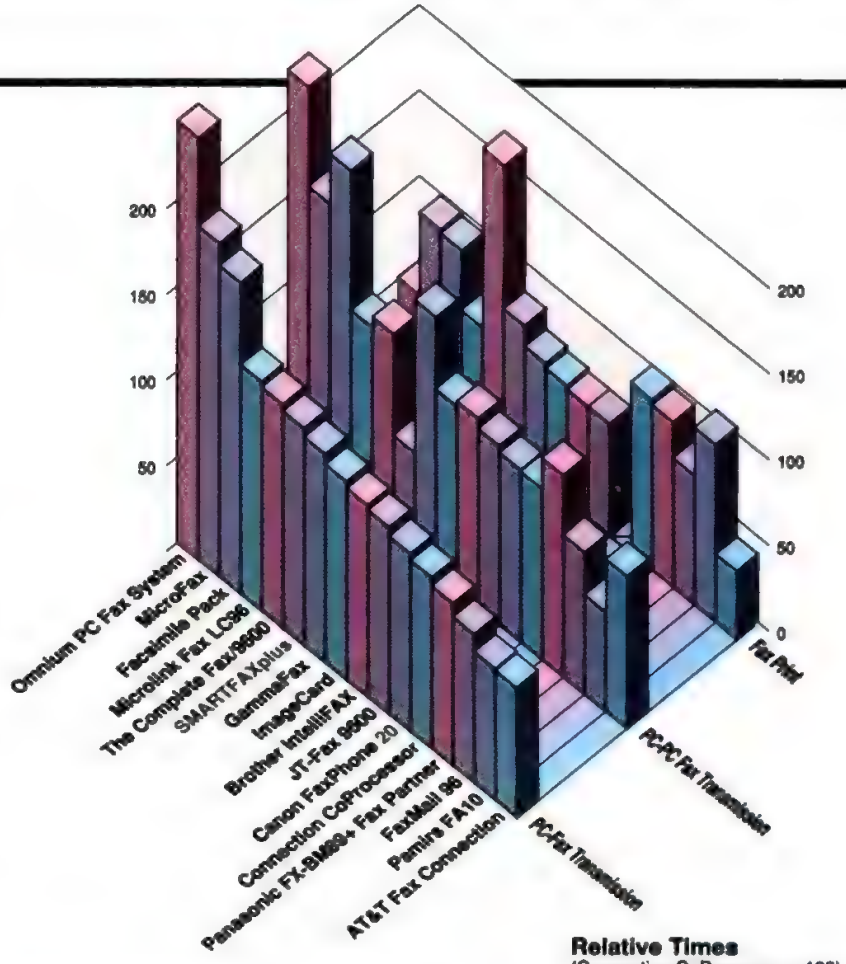
Since we last tested fax boards for PCs, the field has broadened and the quality has improved. But the more things change, the more they stay the same: the performance times yielded by this crop of fax boards proved similar to those of the last group.

For the sake of comparison, we tested the transmission time between two standalone fax machines, each of them a Canon FaxPhone 20. In the PC-Fax Transmission test, only five of the 15 tested fax boards (the AT&T Fax Connection, the Pamirs FA10, the FaxMail 96, the Panasonic FX-BM89+ Fax Partner, and the Connection CoProcessor) were faster than the standalone pair with its 77-second timing.

The GammaFax, which produced very poor timings on PC Labs' Fax Print benchmark test last year, now achieves a respectable score of 99 seconds. Several other boards also substantially improved their print speeds, leaving behind The Complete Fax/9600, which once again delivered a poor print time of almost 4 minutes.

Except in the case of the AT&T Fax Connection, fast printing did not necessarily coincide with fast transmission. Not only was the AT&T Fax Connection the fastest in the PC-Fax Transmission benchmark test, it was also the fastest in our Fax Print benchmark test, delivering a paper copy of our 2-page fax transmission in less than a minute.

As in the past, some products were tested with the Canon FaxPhone 20 and others with the Ricoh FAX60, because a number of boards had trouble handshaking with the former machine. The choice of a receiving fax machine normally does not affect performance times.



Relative Times
(Connection CoProcessor = 100)

Performance Times
(Times given in seconds)

	PC-Fax Transmission	PC-PC Fax Transmission	Fax Print
Omnium PC Fax System	182	170	71
MicroFax	144	126	137
Facsimile Pack	135	148	135
Microlink Fax LC96	99	86	86
The Complete Fax/9600	97	91	231
SMARTFAXplus	94	46	116
GammaFax	90	114	99
ImageCard	86	82	94
Brother IntelliFAX	83	84	92
JT-Fax 9600	81	80	92
Canon FaxPhone 20	77*	77*	N/A
Connection CoProcessor	74	76	139
Panasonic FX-BM89+ Fax Partner	70	90	135
FaxMail 96	64	63	105
Pamirs FA10	57	44	145
AT&T Fax Connection	56	68	56

* Transmission between two standalone FaxPhone 20 machines.
N/A—Not applicable: the FaxPhone 20 does not print to an HP LaserJet, nor does it save fax output for later printing.

The **PC-Fax Transmission** benchmark test times the transmission (without printing) of a 2-page letter in an ASCII text file. Each product is timed on an 8-MHz IBM PC AT, transferring the test file to a standalone fax machine.

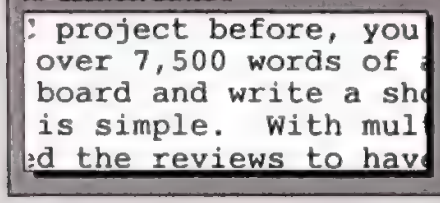
The **PC-PC Fax Transmission** benchmark test times each package as it transfers the same file to an identically configured AT with the same model fax board. This test lets the package benefit from any proprietary features that might override the standalone fax standard.

The **Fax Print** benchmark test times the printing of the 2-page test letter received in the fax transmission benchmark tests. An HP LaserJet Series II is used for this test, and timing is measured from the issue of the print command to the completion of printing.

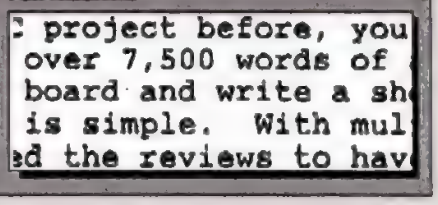
The output of a transmission to a fax machine from a PC may look better than what results when you send a document from one fax machine to another. The reason is that standard fax machines scan the document before sending it over the phone line, and some resolution is lost in the scanning process. PC fax skips the scanning process, sending the document file directly from your computer. The resolution of all faxed output conforms to the Group 3 standard of 200 dots per inch.

You can see the degradation in the image of a text file printed on the HP LaserJet Series II and sent from one fax machine to another, compared with the quality of text files sent by the PC fax packages reviewed here. Of course, how well you like the output produced by a PC fax package may depend on the fonts the package uses. Those we tested have their own fonts, and the user has little control over their appearance. Note that 7 of the 15 PC fax packages—AT&T Fax Connection, FaxMail 96, Brother IntelliFAX, The Complete Fax/9600, GammaFax, JT-Fax 9600, and ImageCard—do not place a slash through the number 0 to distinguish it from the letter O.

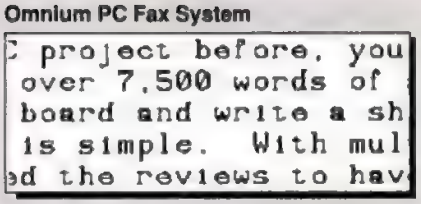
HP LaserJet Series II



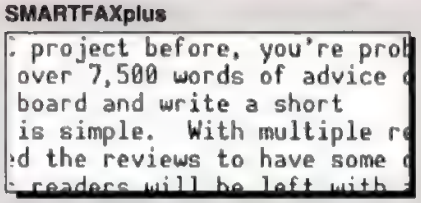
Fax machine



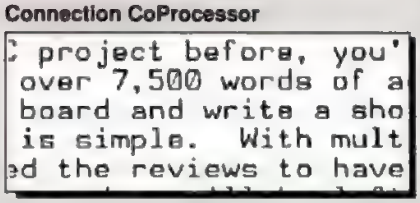
Omnium PC Fax System



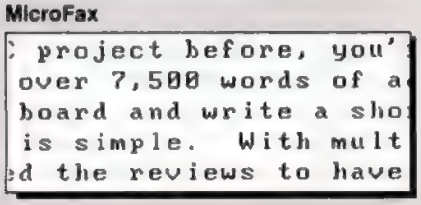
SMARTFAXplus



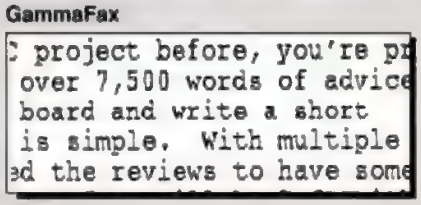
Connection CoProcessor



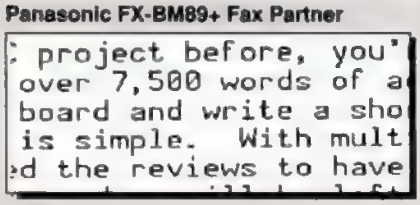
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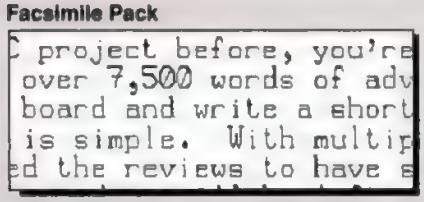
GammaFax



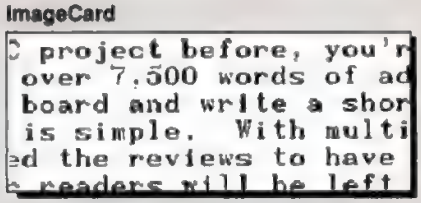
Panasonic FX-BM89+ Fax Partner



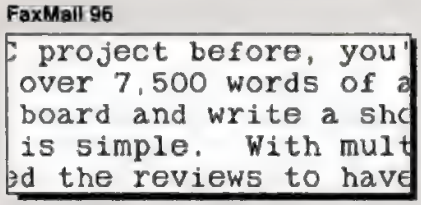
Facsimile Pack



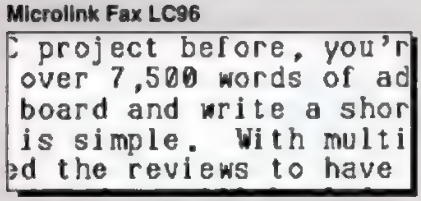
ImageCard



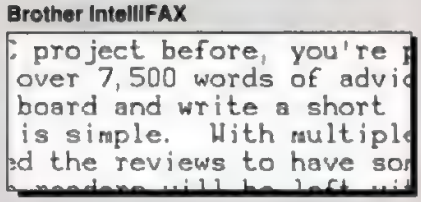
FaxMail 96



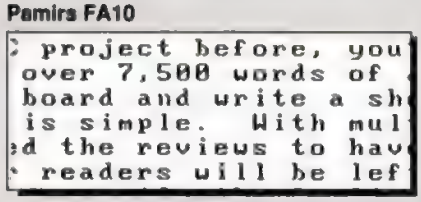
Microlink Fax LC96



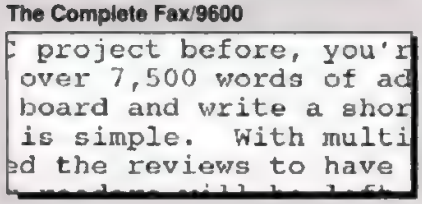
Brother IntelliFAX



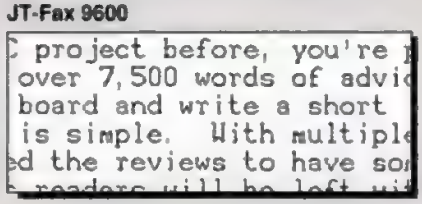
Pamirs FA10



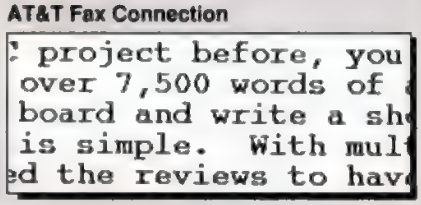
The Complete Fax/9600



JT-Fax 9600



AT&T Fax Connection



retry after it has attempted all other numbers.

Sent and Received Logs record all successful and unsuccessful transmissions, along with time, date, and length of each transmission. A third log shows all files in the queue waiting to be sent. You can cursor to any log entry and view, print, or retransmit your selection.

A PLETHORA OF OPTIONS It's hard to think of transmission options that GammaLink has overlooked. This versatile product's capabilities include turnaround polling and transmission at a later time or date. The powerful script language is still there for automating complex procedures by means of batch files. The program can run in background mode, occupying a little under 200K of RAM (65K with the GammaFax CP). You can even send any sort of data file from one GammaFax board to another.

GammaFax had no trouble performing all our tests at 9,600 bps and turned in respectable performance times. It could even handle the 28-inch-long test page sent from our fax machine. The hard copy generated by GammaFax transmissions was generally of high quality. The graphics file transmitted to our fax machine produced an exceptionally clear, well-defined image mapped pixel to pixel, and text files were very readable. The printout of the PC-to-PC graphics file transmission wasn't as good, however.

The only problem we encountered was that when we transmitted an image scanned by the Hewlett-Packard ScanJet, it came out at double height. GammaLink told us that this was because of a bug in its driver for the ScanJet, which would be fixed in the next release.

On-screen display of faxed files is also good. You can zoom in or out on an image, scroll it, rotate it, or change it to black on white. There are no graphics editing capabilities, but you can extract part of a fax format file. You can also append a graphics file to an ASCII file by means of the rather cumbersome process of appending a command to the ASCII text with a word processor.

The GammaFax manual is for the most part clear and well illustrated. Unfortunately, all the documentation for the script language is in the form of an apparently hastily assembled 150K disk file. GammaLink says it will revise this and put it on paper in a future release.

GammaFax's combination of power and flexibility with a simple, easy-to-use menu system should satisfy the needs of just about any user. It offers a high level of functionality at a reasonable price, proving that this fax board has finally come of age.—**Robert Kendall**

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

Connection CoProcessor
Intel PCEO
Mailstop CO3-07
5200 NE Elam Young Pkwy.
Hillsboro, OR 97124-6497
(800) 538-3373
List Price: $995
Requires: 640K RAM; IBM PC, XT, AT, PS/2 Model 30, and many compatibles, including Compaq; CGA, MCGA, EGA, VGA, or Hercules monochrome-compatible graphics card; DOS 3.0 or later.
In Short: While its list price makes the Connection CoProcessor one of the more expensive fax packages, the excellent error handling, intuitive menu structure, free technical support, and 5-year replacement warranty combine to make it a good choice. In addition, the inclusion of CAS support may turn out to be a valuable feature

CIRCLE 403 ON READER SERVICE CARD

INTEL PCEO

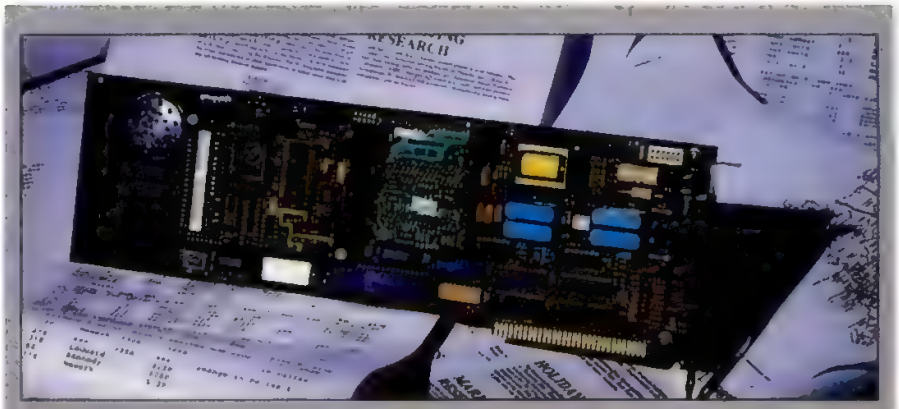
Connection CoProcessor

You always knew that Intel built solid, dependable hardware. But did you also know that the company designs equally dependable software? You'll see the result of that strong combination in the Connection CoProcessor, a $995 fax system that helps define a standard of excellence for other systems to live up to.

As the name implies, the Connection CoProcessor includes an on-board microprocessor. While this feature is not unique, it is certainly a big plus. It allows true background operation, letting the full-length board go about its business while you go about yours. The Connection CoProcessor will occasionally steal time from a foreground application, but only when it needs to read from or write to disk.

The board itself is noteworthy for other reasons as well. Besides the usual modular phone connectors, it sports a connector for the AppleTalk network. As of this writing, the connector is reserved for future use. According to Intel, the connector may disappear from future versions of the board, but it may also serve as a basis for an optional networking capability.

CAS SUPPORT Also remarkable is the fact that the Connection CoProcessor is the first piece of hardware to support CAS (also known as DICAS), the DCA/Intel



The first piece of hardware to support CAS (the DCA/Intel Communicating Applications Specification), the full-length $995 Connection CoProcessor includes an on-board microprocessor that allows true background operation. Besides the usual modular phone connectors, this 9,600-bps board sports a connector for the AppleTalk network.

a Stroke of Genius...



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Dip your brushes into the Orchid palette to create picture-perfect images.

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Features	ProDesigner VGA Plus	ProDesigner VGA	Designer 800 VGA
Bus & BIOS Support	16 and 8 Bit	16 and 8 Bit	8 Bit
Extended VGA Modes			
360x480 256 colors	Yes	Yes	Yes
640x350 256 colors	Yes	With User Upgrade	With User Upgrade
640x480 256 colors	Yes	With User Upgrade	With User Upgrade
800x600 16 colors*	Yes	Yes	Yes
800x600 256 colors*	Yes	With User Upgrade	With User Upgrade
1024x768 16 colors*	Yes	With User Upgrade	No
3 - 132 column 16 color modes	Yes	Yes	Yes
100% Register and BIOS Compatible with VGA, MCGA, EGA, CGA, MDA and Hercules	Yes	Yes	Yes
Auto Mode Switch, Auto 8/16 Bus Sense and Auto Monitor Select	Yes	Yes	No
Suggested Retail Price	$599	$499	$399

* *Supports these standards on both interlaced (IBM 8514 and compatibles) and non-interlaced (NEC Multisync XL and compatibles) monitors*

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Communicating Applications Specification. In principle, CAS will let any software developer add background communications capability (including fax capability) to any application. A word processor, spreadsheet, or database program could pass information to the Connection CoProcessor or other CAS hardware for transmission as fax or data. (For more information on CAS, see the introduction that precedes these reviews.)

Given the promotion of CAS that accompanied the introduction of the Connection CoProcessor, and given a name that clearly reflects Intel's concentration on hardware, you might not expect much from the software side of this system. You'd be wrong: the software is as well designed as the hardware.

■

The Connection CoProcessor helps define a standard of excellence for other fax systems to live up to.

■

The software consists of two separate modules. A background module handles the actual communications. A foreground module takes charge of control functions, letting you designate such particulars as what faxes to send, when to send them, and to whom.

The background module is notable for its excellent error handling. For example, unlike most boards, the Connection CoProcessor breezed through one of the trickier PC Labs benchmark tests, which involves logging on to an empty drive while a fax is being transmitted. Its one failing was in letting the Ctrl-Alt-Del key combination reboot the computer in the middle of a fax transmission. I'd rather see the program trap the Ctrl-Alt-Del combination, warn that a fax transmission is in progress, and ask if you really want to reboot.

MENUS MAKE IT EASY Also on the plus side, the foreground module offers a remarkably easy-to-use menu system. For instance, to send a fax, you choose Fax, Send Fax, then change directories or select one or more files by highlighting each and hitting Return. Continuing with the menus, you select any combination of individuals and groups from your phone book, then choose time to send, resolution (standard or fine), text size (normal or compressed), and whether to send a cover page. As you finish each of these steps, the program automatically takes you to the next. And if any step is not immediately obvious, you can call up context-sensitive help for a detailed explanation. The foreground module also incorporates *PC Paintbrush* as its graphics editor.

You can use the fax modem for file transfer at 9,600 bps, but only if there's a Connection CoProcessor at the other end. Similarly, you'll also find an e-mail feature that works only with another Connection CoProcessor. The e-mail feature lets you create, edit, forward, send, and receive messages. This could be useful if, for example, your company standardizes on the Connection CoProcessor. As a bonus, you can use the text editor in the e-mail module to create documents to send as faxes.

As you might expect of an Intel product, the Connection CoProcessor supports LIM EMS 3.2 and 4.0. As tested without expanded memory, the software needs about 74K of conventional memory. According to Intel, it will use only about 6K with EMS.

WHAT'S MISSING? The only important feature missing from this package is the ability to capture screens or printer output from other applications. Apparently, Intel left out this capability on the grounds that other applications should supply it through CAS. Alas, that won't help much unless—or until—CAS is widely used.

Finally, there is the issue of cost. At $995, the Connection CoProcessor is one of the more expensive fax packages, costing even more than some fax machines. (In part, the high price of the Connection CoProcessor is mitigated by the 5-year replacement warranty and the toll-free technical support that come with the board.) And if you add an extra $295 for an optional 2,400-bps modem, you wind up with even less of a bargain. Much of the Connection CoProcessor's value will depend on how widely CAS is accepted, an issue that is far from settled. Still, if you don't mind the price and judge strictly by quality, the Connection CoProcessor is a clear winner.—**M. David Stone**

MICROLINK INTERNATIONAL INC.

Microlink Fax LC96

Everything about Microlink's Fax LC96 is micro-sized: the short-slot board, the 60-page children's-book-sized manual, the inexpensive price tag, and, in keeping with the tradition, the product's list of features. If you're looking for an economical fax board that handles the basics without any of the frills, the $499 Microlink Fax LC96 is a viable option. But there are a few limitations you should be aware of.

The best news is that your system will be up and running moments after you've opened the package. It's easy to install the board and configure it for a number of telephone installations (PBX, dedicated, and KSU Key Systems), requiring that you merely adjust a few jumper settings. The software includes an installation program

FACT FILE

Microlink Fax LC96
Microlink International Inc.
4064 McConnell Dr.
Burnady, B.C.
Canada V5A 3A8
(604) 420-0366
List Price: $499
Requires: 512K RAM (640K and hard disk recommended); CGA, EGA, or Hercules monochrome graphics card; DOS 2.1 or later.
In Short: A micro-sized fax board with a micro-sized manual and price tag. If you stick to basic transmissions, this board will suffice. But if you want to send multiple messages, print multiple page documents, combine conversions with transmission, and edit graphics, you'll find that this board falls short of the mark.

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COREL software is completely compatible with Novell Netware utilities, security levels, and all existing applications. The world's leading developer of WORM interface software invites you to make the networking breakthrough. For details, contact COREL Systems today!

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COREL

COREL Systems Corporation 1600 Carling Avenue, Ottawa, Ontario K1Z 8R7 Tel:(613) 728-8200 Fax:(613) 728-9790



Microlink's $499 Fax LC96 is an economical short-slot 9,600-bps board that handles the basics without any frills. It's easy to install and configure for various telephone installations, requiring you merely to adjust a few jumper settings.

that configures your equipment and will even modify your AUTOEXEC.BAT file to run the program in the background if you prefer. (Unfortunately, there is no way to remove the resident portion of the program without rebooting the machine.)

The Fax LC96 software relies on a series of easy-to-use pop-up menus. You activate menu choices by pressing function keys. The menus allow you to handle most varieties of send (with/without dial, delay time, select phone number from directory, and so on) and receive (auto or manual). A pop-up country and city code finder is a helpful utility.

The program supports a good number of file format conversions: ASCII, *Dr. Halo*, TIFF, *PC Paintbrush*, and *Windows Paint*. However, you'll have to convert the files in a separate step prior to transmission. There are no facilities to do this as you transmit or to convert from a fax format to another format. Microlink says it plans to include a fax-to-*PC Paintbrush* conversion facility shortly. Since there's no way to pop up a listing of files from the conversion menus, you'll need to rely on memory or make a trip back to DOS to hunt down your filename.

PSEUDO-FEEDBACK The software offers very little feedback while it is engaged in transmission. What you often get is a kind of pseudo-feedback: you get the appearance of feedback when in fact things are really going awry. For example, during transmission a pop-up box with the word Transmitting appears the instant that you specify the Dial command. The box is supposed to remain on-screen until the process is complete. But at certain times the "transmitting" message remained in place even when the process had failed. Packages that display status information messages (waiting for ring, dialing, 50 percent done, and so forth) are considerably more helpful. On the other hand, the program does make sure that an error condition is properly flagged in the activity log.

The program reacts similarly during printing: a pop-up box that says "processing data" appears on-screen even when the printer is working correctly. Finally, the program could not transmit our 28-inch paper; it's limited to a slightly larger than legal-sized format.

Microlink offers few accessory facilities. There is no text editor and no way to attach signature and letterhead files. You are permitted to view a graphics file on-screen, but the FAX LC96 software lacks facilities for editing the file. There is no control over fine (as opposed to normal) resolution, nor are there any gray-scale capabilities. However, the system transmitted all text and graphics in the proper aspect ratio. Fonts have no support either, although the program can handle the ASCII extended character set. In addition, there are some undocumented commands, such as one that moves you to the next page in the viewer.

Certain enhancements to the send menu are helpful, but not enough to satisfy the needs of frequent fax users. There are no facilities for polling. While you can easily send a delayed fax transmission or broadcast a single message to a group of recipients via a phone directory, the program lacks any facility for creating a distribution list to transmit multiple messages—unless you name each message identically and give them consecutively numbered extensions. Furthermore, although the package stores consecutive pages as FAX01.301 and FAX01.302, you cannot print multiple-page documents without specifying each page as a separate file.

In the list of the Fax LC96's omissions, there is a curious inclusion. The Fax LC96 can send binary files via a 9,600 bit-per-second high-speed file transfer. When the manufacturer wanted to send me a bit of additional software code, this feature was a helpful addition. However, you can transfer files only to another Fax LC96 or other Microlink fax board. A micro problem?—**Robin Raskin**

OMNIUM CORP.

Omnium PC Fax System

Does your pioneer spirit rebel against the slick sophistication of most recent fax products? Do you feel an uncontrollable urge to roll up your flannel sleeves, stomp into the wilderness, and dig down to the frontier roots of the fax phenomenon? If so, Omnium Corp.'s $599 Omnium PC Fax System is the board you've been itching for.

Minnesota-based Omnium Corp. doesn't make boards for city slickers who can't imagine living without hot-and-cold running water. City slickers expect their fax software to take ASCII files found anywhere on their disk and convert them automatically into fax format while transmitting them. Omnium's software can locate only files stored in the fax directory, and it makes you convert ASCII files before you can transmit them. To add to the frontier

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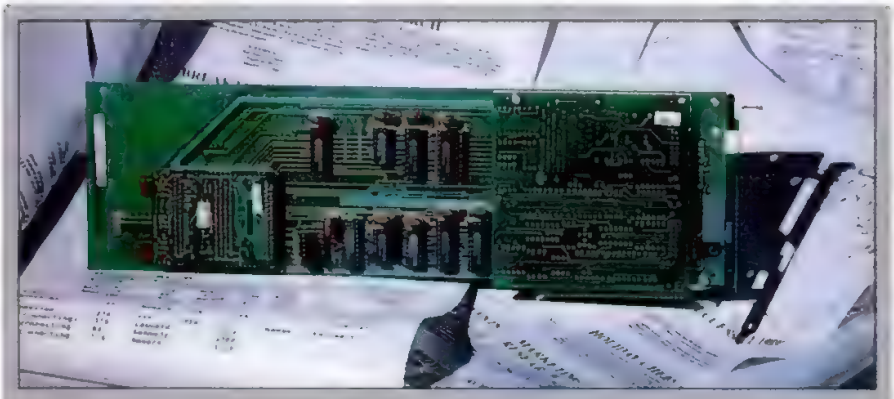
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CIRCLE 250 ON READER SERVICE CARD



The only board tested that transmits at the leisurely pace of 4,800 bps, Omnium Corp.'s $599 Omnium PC Fax System shows good workmanship and an uncrowded layout. One oddity, however, is a small transformer that pokes through a hole in the back of the board and may interfere with an adjacent card.

challenge, Omnium insists on converting a multipage ASCII file into a group of separate files, one per page. Any incoming multipage file gets the same treatment and is converted into multiple files that you have to read or print separately.

CITY FAX, COUNTRY FAX City slickers expect fax software to report the length of each transmission in the log file and to present error messages in clear English. Omnium makes you get out the calculator to figure out the length of any call and presents errors in the form "ERRFLG = 35". If you want to know what the number means, get on the phone to Omnium, and don't waste time looking for explanations in the manual. Whenever the Omnium board sends or receives a file, it displays the hex codes of the first few seconds of data. Real men understand sequences like "B3 A0 A4 B2 09 B4 60" when they see them.

City slickers expect their fax software to receive files in the background while they get other work done. Omnium's foreground-only software takes over your computer whenever you send or receive. City slickers expect their fax software to control a scanner. Omnium expects you to use the scanner manufacturer's software to create .PCX or *Dr. Halo* files, and then use Omnium's software to convert them into fax format.

City slickers expect their fax boards to have both a line jack and a phone jack. Omnium gives you one jack only—although it throws in a plastic Y-connector that you can use to plug in a phone.

LIFE IN THE SLOW LANE Frontier folks don't suffer from the same frantic time pressures as city slickers, so they won't mind waiting 30 seconds while Omnium's software converts a 1¼-page ASCII file into two fax files, and then another 2½ minutes while Omnium's hardware transmits the two files at the leisurely pace of 4,800 bits per second. Frontier typography has never been known for elegance, and Omnium maintains the tradition by using a nearly unreadable font with some letters too thick or too thin, and with the numeral 2 almost indistinguishable from a capital Z.

Omnium doesn't intimidate you with a slick manual or software. As documentation, you get 40 spiral-bound pages, some of them pasted over with foldout updates. And you won't find the manufacturer's address or phone number anywhere in the manual.

The software doesn't let you do anything as simple as press Enter to confirm your choices. Instead, you have to keep pressing F10 as a confirm key when you think you've already told the software everything it needs to know.

When you want to do anything with your fax files, Omnium doesn't even automatically give you a menu of available files. To view a fax, for example, you press V at the main menu to get to the View menu, press F2 to see the list of files (each file containing a single page), move the cursor to the one you want, then press Enter to move it into the filename field. Since you can choose only one file at a time, this should be enough to get you started—but now you have to press F10 to start the viewer.

After a fairly long wait, you can see the chosen page in white on black. Although most of Omnium's software is menu driven, nothing on the screen even reminds you that to change the scale of the viewed image, you have to press Z and then a number from 1 to 4. You can't change the default scale, which produces an easily readable image with a Hercules card, and a less readable one with an EGA. You have to go through the View-F2-Enter-F10 procedure with every page in a multipage file.

At least the print menu lets you list a series of incoming pages before printing them to an Epson- or HP-compatible printer. But if you want to send a multipage file to more than one destination, you have to prepare a separate list of each destination for each page of the file.

One of the two Omnium boards tested in PC Labs was unable to receive data from the other without timing errors that invariably caused it to break off the transmission. Omnium first traced the problem to the fact that its software is optimized for 256K machines and PC Labs had 640K. But when the other board performed well in the same machine, Omnium's tech support was unable to offer an explanation.

PC MAGAZINE FACT FILE

Omnium PC Fax System
Omnium Corp.
1911 Curve Crest Blvd.
Stillwater, MN 55082
(P.O. Box 186)
(800) 328-0223
List Price: $599
Requires: 256K RAM; CGA, EGA, VGA, Hercules monochrome graphics card; DOS 3.0 or later.
In Short: Omnium's foreground-only software has limited capabilities, an unappealing font, and no scanner control. Multipage documents are sent and received as multiple files.

CIRCLE 406 ON READER SERVICE CARD



A Brand New Resolution
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HS-3000



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With DFI's new HANDY SCANNER (HS-3000), scanning BIG pictures has become a breeze.

The HS-3000 is the first hand-held scanner to offer four (400/300/200/100) DPI resolutions for the IBM PC/XT/AT, PS/2 Models 25/30 and their compatibles. Able to scan an image 4-1/8" wide, it also has some unique features such as : 32 levels of grey resolution (others only have 16 levels), a fast 7-sec. scanning speed (for 10" at 300 DPI) and a yellow-green light which captures the reddish skin tones of your images (scanners with red lights just can't see the all-important skin tones), thereby giving you sharper pictures. What's more, a real-time screen display lets you instantly see your scanned image, so you can quickly make the necessary adjustments, if needed.



With its accompanying software, you can quickly scan, bit-edit, crop, save and use the images under graphics packages such as PageMaker, Ventura, WordPerfect 5.0, PC Paintbrush +, and many others.

You can scan dot matrix, typewriter and laser printer monospaced texts and use them in your word processor. The trainable OCR software has the exclusive ZIP feature which lets you merge 2 scanned pages into one.

The HS-3000 package includes the scanner, interface card, a utility disk, an instruction manual and the HALO DPE graphics editor/layout program.

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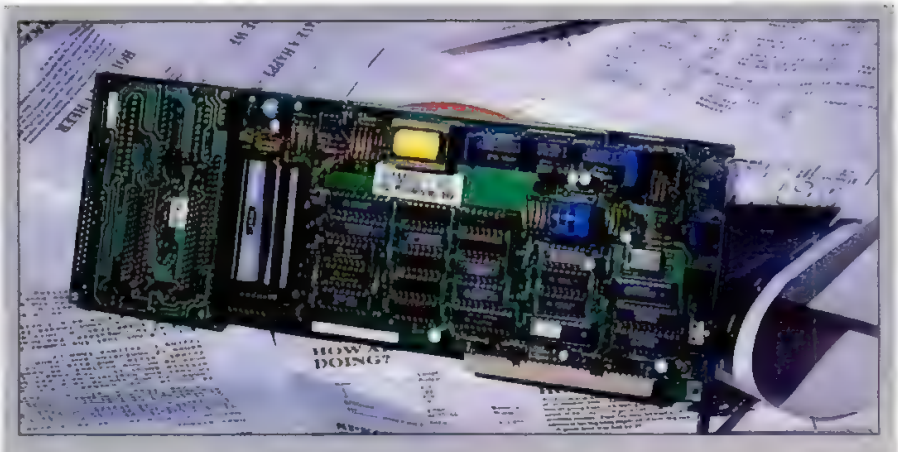
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CIRCLE 742 ON READER SERVICE CARD

A FEW CONVENIENCES The frontier spirit of the Omnium system allows for a few conveniences. Installation is simple. You can pop up an editor screen and write a message that the program will convert directly to fax format and send. The editor doesn't have word wrap, so you have to press Enter at the end of every line and you can't type more than one screen, but for a quick message it's enough.

Omnium's full-length board shows good workmanship and an uncrowded layout. One oddity is a small transformer that pokes through a hole in the back of the board and may interfere with an adjacent card.

The Omnium PC Fax System works happily with a two-floppy system, and its software is designed to work with 256K of RAM. If you're using this kind of log-cabin system, the Omnium board will fit right in.—**Edward Mendelson**



For $30 above its list price of $565, you can purchase the ¾-length 9,600-bps Pamirs FA10 with an Auto-on option, which can sense an incoming fax transmission when your computer is turned off, then power up your system. Once the computer is running, the software takes over and receives the fax.

PAMIRS BUSINESS INTERNATIONAL CORP.

Pamirs FA10

You're asleep at home and your colleague from across the country wants to fax something to you immediately. Ordinarily, you'd have to leave your computer running with the fax software loaded. Not with the Pamirs FA10. This ¾-length fax board has an Auto-on option that can sense an incoming fax transmission and then power up your computer system, after which software takes over and receives the fax. And just so your system doesn't stay on all night, the Auto-on option shuts your system down when it has finished receiving the fax.

The Pamirs FA10 used to come standard with the Auto-on feature and cost $795. Last December the vendor lowered the price and unbundled that feature from the board. Now you can buy the fax board and software for $565, or $595 with the Auto-on feature. The $30 price differential makes it worth purchasing this option even if you'll use it only infrequently. (The Pamirs system isn't the only one with an automatic power-up option; American Data Technology's SMARTFAXplus has one too, but its feature costs $299 over the price of the board.)

EDIT AND COMMAND MODES In most other respects, the Pamirs FA10 is a fairly straightforward 9,600-bit-per-second PC fax system. The FA10 includes a minimal editor that lets you write and edit short documents, as well as draw lines and boxes. You can also use the editor to create listings for mass faxing.

The Edit mode is one of the FA10's two opening modes. The other is the Command mode. You'll spend most of your time in the Command mode, which lets you control the system's operations via the function keys; these are displayed in a horizontal bar menu at the bottom of the screen. Each of the major operational areas has its own "subfunction" menu.

The Pamirs FA10 software operates as a standalone program or as a TSR. When sending or receiving, it comes into the foreground and controls the computer for the duration of the fax transmission or reception. You can turn reception off if you don't want to be interrupted for a time.

The FA10's use of system memory helped it pass our error handling tests with flying colors. The only interruption of a receiving fax occurred when we rebooted the receiving computer, and even then the transmitting computer just rescheduled the fax for later transmission. Putting the receiving machine in situations that frustrated lesser systems, such as reading an empty floppy disk drive or pausing a screen, didn't faze the FA10 at all.

BEYOND FAX MACHINES The FA10 has a reasonable selection of features not found in regular fax machines, though the list is not as extensive as that of some of its competitors. For example, you can use calling groups for distributed faxing, and you also can view and print a transaction log. You cannot, however, capture a screen or capture output formatted for a printer, either for immediate or subsequent transmission. Both normal- and high-resolution modes are available, as are normal and compressed fonts. The FA10 will support gray-scale images from a scanner, but

PC MAGAZINE FACT FILE

Pamirs FA10
Pamirs Business International Corp.
550 Lake Site Drive, #2
Sunnyvale, CA 94086
(408) 736-2583
List Price: $565 without Auto-on option ($595 with Auto-on option)
Requires: 384K RAM (hard disk recommended); CGA, EGA, or Hercules graphics card; DOS 2.0 or later.
In Short: It may lack some of the fancy features of other fax systems, but the Pamirs FA10 is an adequate performer. It can set up 20 different groups of up to 800 numbers each for mass broadcasting of faxes. Software includes a functional word processor.
CIRCLE 408 ON READER SERVICE CARD

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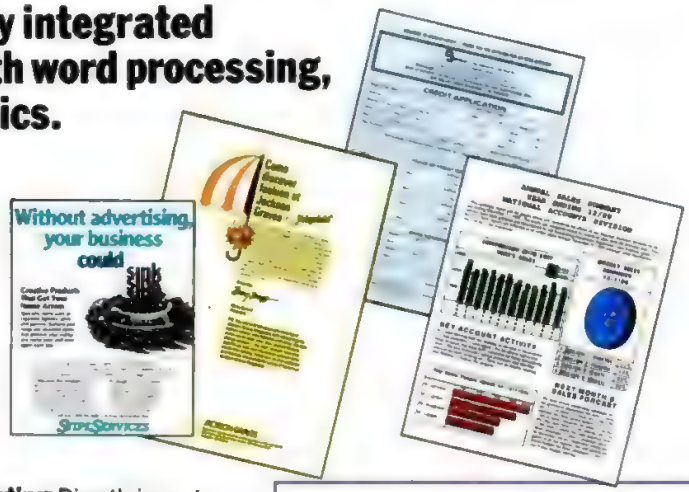
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CIRCLE 248 ON READER SERVICE CARD

has no specific gray-scale support or enhancement of its own. As a result, the system produced a pretty good replica of our test photo and color wheel, but the results were not as good as those produced by units with specific gray-scale support.

The most recent version of the Pamirs FA10 converts from *PC Paintbrush, Dr. Halo, Windows Paint,* and ASCII format files, as well as Pamirs's proprietary .IMG file format. The vendor plans to support conversion in the other direction, but there is none so far.

The FA10 works well with fax machines and even has a plug for a "local" fax to use a fax machine as a scanner. Pamirs supports the Canon IX-8 and IX-12, HP ScanJet, Microtek MS-200C and MS-300C, Telescan, and Digitech hand-held scanners. It also works with many printers, including the HP LaserJet, but it does not work with PostScript printers.

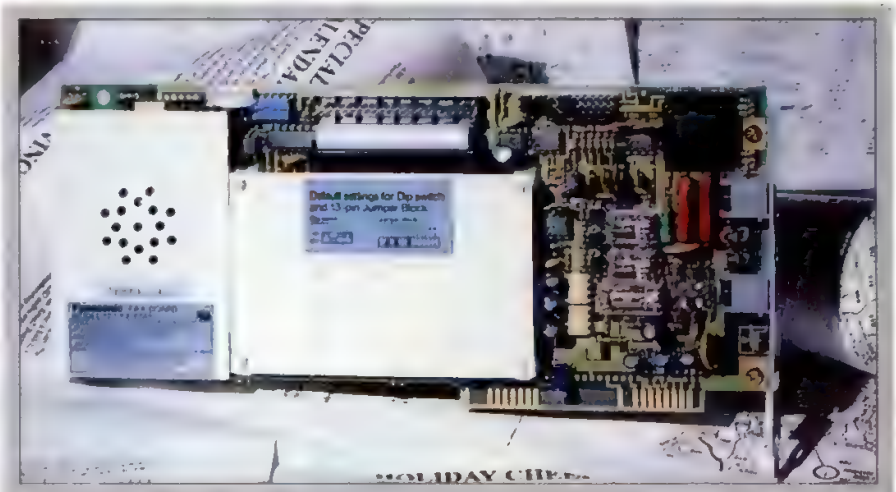
When the FA10 transmits to another FA10 unit, it recognizes its sibling and speeds up considerably. Of course, you still have to print the received file to get hard copy, and the Pamirs takes a good while at this task. In general, though, this is a speedy system—at least until printing time.

The Pamirs FA10 is a solid performer with some special features. According to the vendor, future versions of the software will include many of the currently missing features, such as screen and printer capture. For now, however, the system works well, and at just $565—or $595 with Auto-on—it's a good deal.—**Bruce Brown**

PANASONIC CORP.

Panasonic FX-BM89+ Fax Partner

Panasonic keeps adding conveniences to its already impressive fax board, the $999 FX-BM89+ Fax Partner. This is essentially the same board that received a warm welcome to the fax scene in *PC Magazine*'s first roundup (June 28, 1988). It is graced with mostly intuitive menu-driven software that runs in background and TSR modes and supports polling of remote systems. But the plus sign recently added to the ungainly name of this ⅔-length board signifies some important improvements.



The plus sign added to the ungainly name of Panasonic's $999 FX-BM89+ Fax Partner signifies some important improvements, among them the fact that you don't need to take the extra step of creating ASCII files in your word processor whenever you want to transmit text via this ⅔-length 9,600-bps fax board.

With Panasonic's latest software, for example, you don't need to take the annoying extra step of creating ASCII files in your word processor whenever you want to transmit text via the fax board. You tell the installation program which of ten popular word processors you use, and the software automatically converts the word processor's files into fax format when transmitting. Also, you can now transmit directly from a scanner—even a scanner with a multipage feeder—without going through any intermediate file-saving steps. Further improvements, especially in Panasonic's slightly rough-edged graphics and viewing functions, are due in a new version of the software, which should be available by the time you read this review.

CABLE NOT INCLUDED Panasonic's Fax Partner is a well-constructed ⅔-length board with separate jacks for the line and the phone, a built-in speaker, and a small external box with two LEDs that signal when the board is sending or receiving. The one item absent from the package is a standard cable to connect the board to the phone jack in the wall. If you don't have a spare cable, don't try to install this board when the local hardware store is closed, or you'll be very frustrated.

When you go to the hardware store for the cable, also pick up a small screwdriver to pry off the magnet that Panasonic uses for mounting the external LED box to your computer. Cheap magnets and valuable data don't belong in the same room. I had no trouble destroying a floppy with Panasonic's magnet. If you have a Panasonic computer, get the FX-BM88 model instead, with an LED box that replaces the LED box on the front of the machine and doesn't use a magnet.

The Fax Partner lets you print your incoming faxes to just about any standard dot

PC MAGAZINE FACT FILE

Panasonic FX-BM89+ Fax Partner
Panasonic Corp.
Panasonic Industrial Co.
2 Panasonic Way
Secaucus, NJ 07094
(201) 348-7000
List Price: $999
Requires: 640K RAM; minimum 10MB hard disk; CGA, EGA, VGA, or Hercules graphics card; 8-bit expansion slot; DOS 3.1 or later.
In Short: Straightforward to install, the FX-BM89+ offers intuitive software with some awkwardness in the viewer and graphics editor. Efficient memory-resident scheduling and powerful scanner control make this a board worth considering.

CIRCLE 407 ON READER SERVICE CARD

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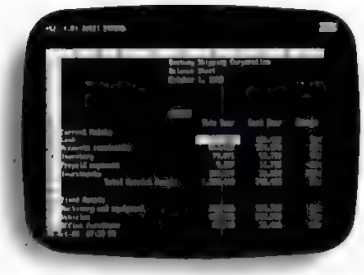
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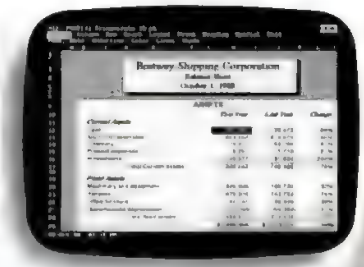
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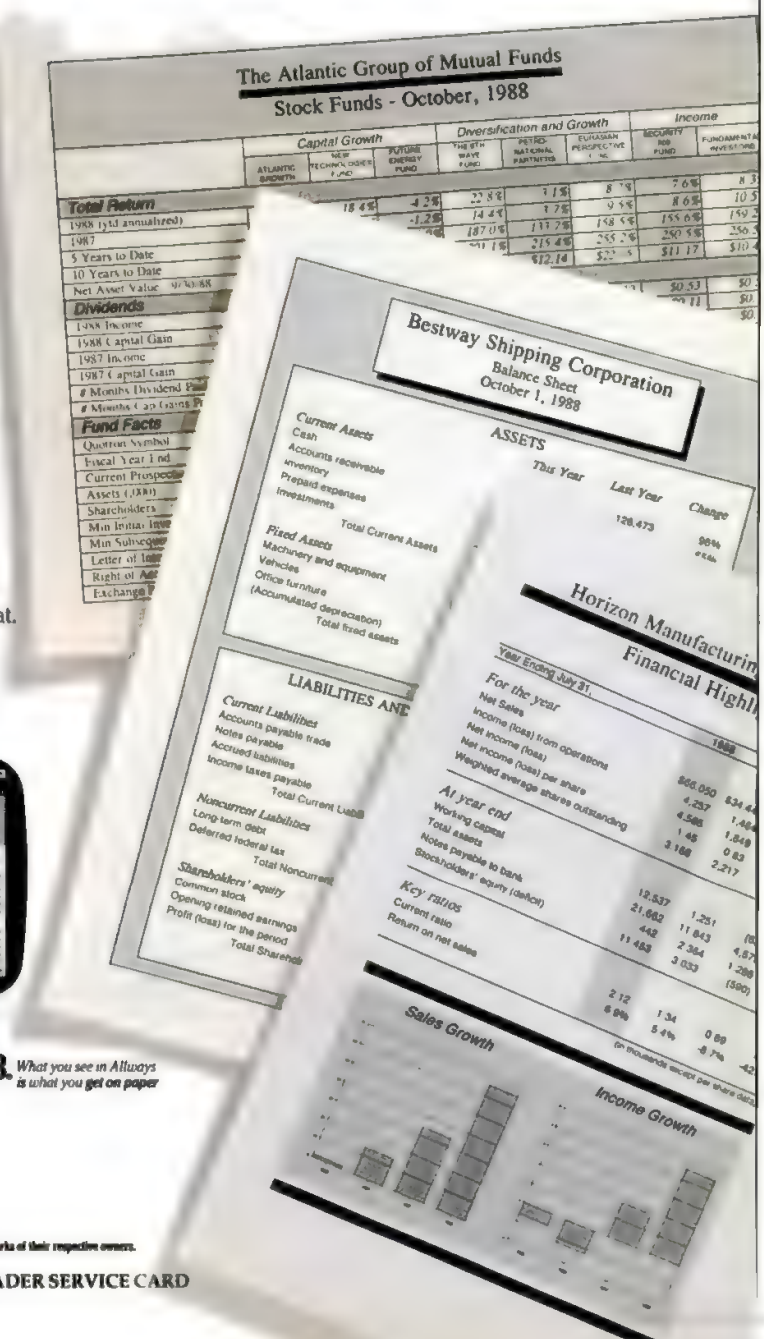
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CIRCLE 237 ON READER SERVICE CARD

matrix or laser printer, and you can use the accompanying fax software to drive scanners made by Panasonic, Canon, Microtek, or HP. You choose files to send from a point-and-shoot menu that can present any directory on any drive. The software automatically converts ASCII files, *PC Paintbrush* .PCX files, and scanned .DCX files, as well as files from your selected word processor.

The installation program lets you specify a header for each page or a lead file that precedes every transmission, or both. You

■

The Fax Partner wasn't fazed by any of the error conditions thrown at it during our tests.

■

can easily create distribution lists and lists of numbers to poll for remote transmissions. Scheduling for later dates and times is easily arranged and just as easily rearranged if you change your mind.

BACKGROUND OPERATIONS Once you schedule your transmissions and set the software to receive automatically, you can return to your other applications and let the 16K resident scheduler lurk in the background. The TSR software won't let you reboot during a transmission, and it wasn't fazed by any of the error conditions thrown at it by the PC Labs performance tests. You can set up the software to print all incoming faxes automatically, but the program can do this only while you run it in the foreground.

The built-in fax viewer, a modified subset of ZSoft's *PC Paintbrush*, is slower than it ought to be and uses a completely different menu structure from that of the main software. You'll need a mouse if you don't want to waste your time using the arrow keys to push the pointer across the menu a millimeter at a time. The viewer includes an option to print a fax in high-resolution mode. You should use it if you want decent printouts, because the low-resolution mode available from the fax-printing menu in the main part of the software tends to give grainy or washed-out graphics images, although text is perfectly readable.

When converting text files to fax mode, Panasonic uses a clumsy sans serif font. Its defects are partly balanced by the availability of a compressed font that can be used for spreadsheets or any text up to 132 columns wide. And when you send text or graphics from a scanner through the Fax Partner to a remote fax machine, the results are extremely impressive. PC Labs' test photo and color wheel were reproduced at the remote fax with perhaps the best possible detail available from 200-dot-per-inch resolution of the Group 3 fax standard.

One of the choices on the software's Utility menu is a graphics editor that turns out to be ZSoft's *PC Paintbrush*. This is a powerful program that isn't fully integrated into the rest of the software, and many of its functions, such as flipping and inverting areas of the image, would be more useful in the viewer.

Panasonic's board is a combination of minor quirks and major strengths. It's a superb product for sending faxes, and only its awkward graphics functions keep it from being a superb product for receiving.—**Edward Mendelson**

QUADRAM LIMITED PARTNERSHIP

JT-Fax 9600

When *PC Magazine* reviewed PC fax boards in the June 28, 1988, issue, Quadram's $395 JT-Fax was a favorite because of its price, features, and intelligent menu structure. It also stood out as a finished product in a field that might have been described as not quite ready for prime time. Quadram still sells the board, which was a bargain then and still is. But with its newest offering, the $795 JT-Fax 9600, the vendor has addressed the original product's drawbacks: its limitation to 4,800-bit-per-second operation and a TSR feature that popped up in the middle of other applications when receiving or sending faxes.

With a price more than double that of the JT-Fax, the JT-Fax 9600 is still a good deal. The maximum transmission speed, as indicated by its name, is 9,600 bps. Background operation in this version also stays in the background where it belongs. The JT-Fax 9600 retains the intuitive menu structure of the original product, and its impressive list of extra features, if not enlarged noticeably, is still one of the fullest available.

The JT-Fax 9600 board itself is a ⅔-length card that plugs into any 8- or 16-bit slot. Memory address and interrupt settings reside on the card, but all other configurations and features are controlled by software. The configuration program is easy to use, which helps because to name a new calling group (a list of numbers to call in a batch), you'll have to run it again—a minor inconvenience.

STANDALONE OR RAM RESIDENT You can run the JT-Fax 9600 software as a standalone program, a good idea if you don't send or receive many faxes. Why tie up any memory at all or have any slowdown in disk access or CPU speed? In most common operation, however, the JT-Fax 9600 software is run as a RAM-resident program that checks periodically for incoming faxes, which it will then automatically save. You can set it to print all incoming faxes that are received during the

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

JT-Fax 9600
Quadram Limited Partnership
1 Quad Way
Norcross, GA 30093
(800) 548-3420
List Price: $795
Requires: 640K RAM (hard disk recommended); IBM PC, XT, AT, PS/2 Model 25 or 30, compatible; CGA, EGA, VGA, or Hercules graphics card; DOS 2.0 or later.
In Short: The JT-Fax 9600 improves on the popular JT-Fax with an increased 9,600-bps maximum transmission speed and true background operation. Its software, which can run as a standalone program or a TSR, features an intuitive menu system and includes such extras as screen capture, printer capture, and calling group utilities.

CIRCLE 408 ON READER SERVICE CARD

PC MAGAZINE

"The Dataworld 286 [12MHz] AT compatible... [is]... the fastest machine of the nine tested in that review [July 1988]." (September 27, 1988).

and

"... speed and excellent compatibility... hundreds of dollars less expensive than other AT compatible."

PC MAGAZINE EDITOR'S CHOICE

"Marvelously cheap, powerful alternative ... outperformed the other 286's ..."

(October 11, 1988)

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20MHz 286
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DATA-286 12MHz

80286 running at 8/12Mhz, 0/1 wait state
Phoenix BIOS std. (Award BIOS opt.)
512KB of RAM, expandable to 1MB on board
Socket for 80287-8, -10
200W power supply
Real-time clock with battery backup
1.2MB floppy disk drive
Floppy/hard disk controller
(1:1 interleave controllers available)
101-key keyboard with "click"
Mono card w/parallel port (720x348)
TTL monitor with tilt/swivel base

$1195



Portacomp II

80286 running at 8/12Mhz, 0/1 wait state
Phoenix BIOS std. (Award BIOS opt.)
512KB of RAM, expandable to 1MB on board
Socket for 80287-8, -10
Real-time clock with battery backup
1.44MB 3.5" floppy disk drive
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Supertwist backlit LCD, 640x400 res.
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Weighs under 20 Lbs.
1.2MB external floppy drive opt.
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DATA-286 20MHz

80286 running at 10/20Mhz
AWARD BIOS std.
1MB of RAM, exp. to 2MB on board
EMS 4.0 support for memory over 1MB
Socket for 80287
200W power supply
Real-time clock with battery backup
1.2MB floppy disk drive
1:1 interleave floppy/hard disk controller
101-key keyboard with "click"
Mono card w/parallel port (720x348)
TTL monitor with tilt/swivel base

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Floppy/hard disk controller
101-key keyboard with "click"
Five 16 and two 8-bit slots
Mono card and monitor **$1995**



Portacomp I

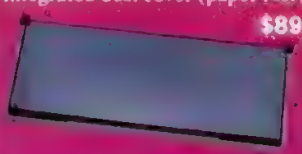
8/12MHz, 0/1 wait
Phoenix BIOS std. (Award opt.)
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200W power supply
1.2MB 5.25" floppy drive
20MB hard disk drive
Supertwist backlit LCD
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5 expansion slots
1 parallel, 2 serial ports **$1875**



Dataworld Keyboard

101-key enhanced layout
L-shaped large return key
Integrated dust cover (paper rest)

$89





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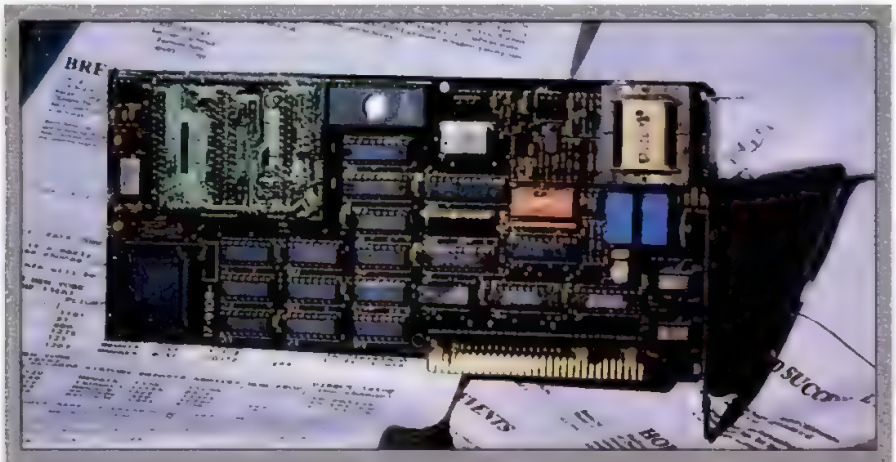
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DATAWORLD

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With the $795 JT-Fax 9600, Quadram has addressed the drawbacks of its original JT-Fax board: its limitation to 4,800-bps operation and a TSR feature that popped up in the middle of other applications when receiving or sending faxes. The software that accompanies the ⅔-length card still retains the intuitive menu structure of the original product.

night, for example, so you don't have to wait to print them or view them on-screen the next morning.

While you are using other software with the JT-Fax 9600 software resident, other applications will slow down only while you are sending or receiving faxes. Unlike its slower, less expensive sibling, the JT-Fax 9600 does not make you stop all other operations while it receives or transmits.

AS EASY AS IT GETS You control all operations through simple menus. I've seen several people walk up to a computer with the JT-Fax software running and successfully send a fax from a stored file without having to look at the documentation or ask a question. You can't get much easier than that. New utility programs also let you transmit, print, and display faxes directly from the DOS command prompt.

You can save fax numbers in a telephone directory and also assign them to one or more calling groups for mass transmission. You can also chain files for inclusion in a single fax. You can either transmit faxes immediately or schedule transmission for a later time. In addition, you can print a transaction log of transmitted and received faxes and failed attempts.

The JT-Fax's normal method of operation is to convert scanned input or disk files to fax format at the same time as transmission, although you can opt to preconvert files. While doing the latter slows down the transmission process, it also saves considerable disk storage space.

Besides standard fax operations, the JT-Fax 9600 has a screen-capture facility and a printer-capture feature that lets you fax text files formatted for an Epson FX-80 or compatible printer. You can insert signature, letterhead, or text files in faxes and can send and receive *PC PaintBrush* files directly. When you buy a JT-Fax 9600, you get a $40 coupon for Inset Systems' $99 program *HiJaak*, which includes a JT-Fax conversion utility to let you use graphics and other files from a wide variety of programs. This is just one of several programs coming from other vendors that aid the use of JT-Fax products with various application packages. Quadram's Asher Fax Division is aggressively working with other vendors to establish the JT-Fax line as an industry standard.

PEACEFUL COEXISTENCE JT-Fax boards work with all Group 3 fax machines, and Quadram reports that earlier problems with idiosyncratic fax machines have been cleared up. The Asher Fax Division also maintains a bulletin board from which registered users can download the latest copy of JT-Fax software.

The JT-Fax boards support a wide variety of scanners and printers—among them scanners from Brother, Princeton Graphics Systems, Hewlett-Packard, Canon, and Chinon; and printers from Brother, Epson, Genicom, IBM, and Hewlett-Packard. Our printed test samples looked very good, both in normal- and high-resolution modes. The board handled the oversized 28-inch test sample with ease, and the gray scale of the scanned image also looked pleasing.

If you don't need the extra speed and don't mind halting other computer applications when you send or receive a fax, the $395 4,800-bps JT-Fax internal version ($495 for the external version) may be all you need at less than half the price of the JT-Fax 9600. But if you need speed and want background operation, the JT-Fax 9600 is the one to look at.—**Bruce Brown**

RICOH CORP.

ImageCard

If anyone knows how to build a fax board, it ought to be Ricoh. As one of the leaders in fax machines, Ricoh has a wealth of experience to draw on. And, indeed, the $1,175 ImageCard hardware is just as good (and as expensive) as you would expect.

The full-length ImageCard board sports a microprocessor to handle background operations and a proprietary chip that decompresses each line of a received fax, looks at the error code, and recompresses it before saving the data to disk. This results

PC MAGAZINE FACT FILE

ImageCard
Ricoh Corp.
5 Dedrick Pl.
West Caldwell, NJ 07006
(201) 882-2000
List Price: $1,175 (to change); *ImageNet* data communications software, $395.
Requires: 640K RAM; DOS 2.1 or later
In Short: The Ricoh ImageCard is designed as a broadcasting tool for heavy fax users. In effect, it offers a wide-area-network fax-file server for fax machines and PCs equipped with Ricoh's *ImageNet* software. While not a good choice for simply adding fax features to a PC, it may be the only choice for those who need the broadcasting features.

CIRCLE 409 ON READER SERVICE CARD

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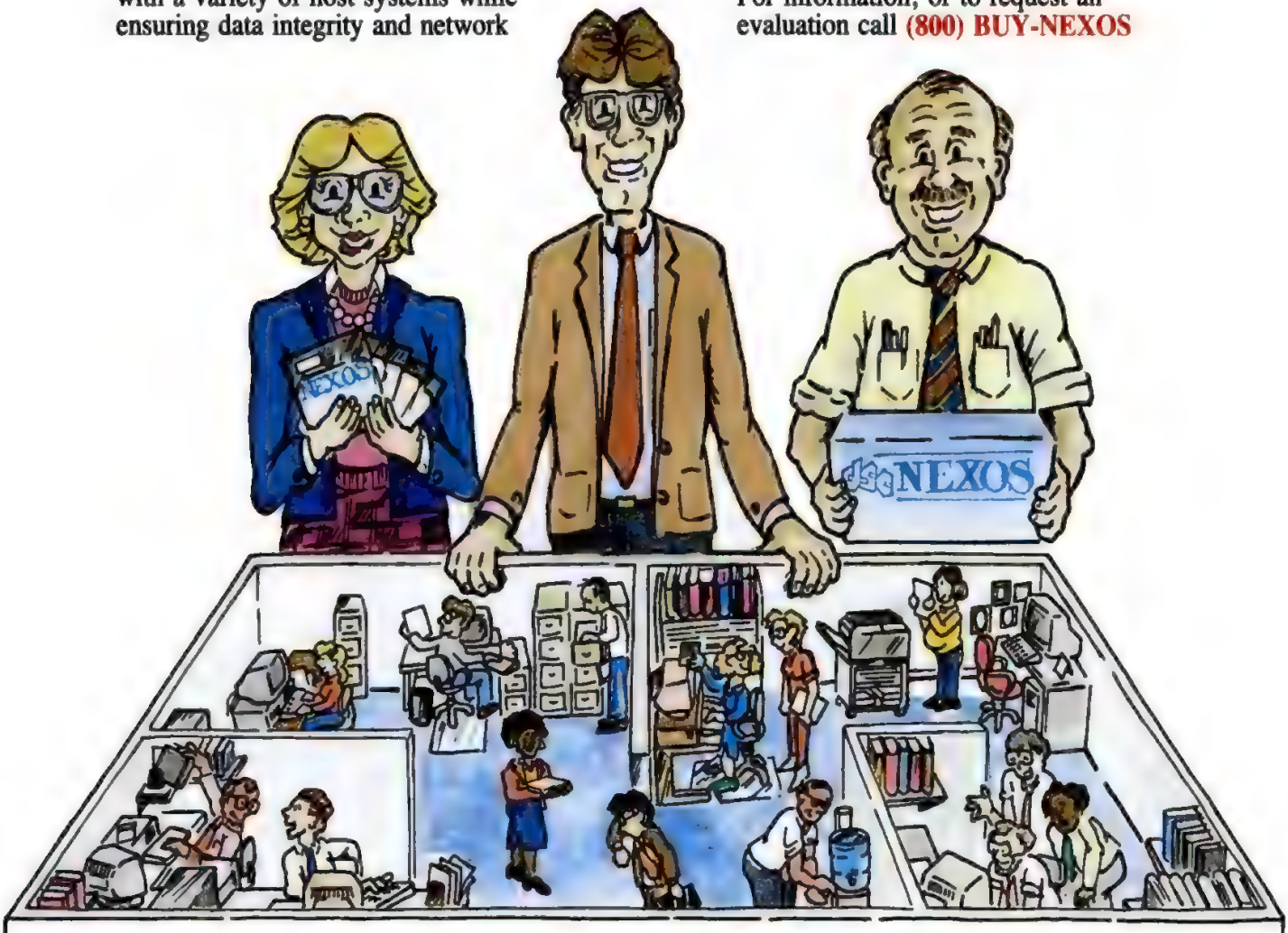
The NEXOS 386 protected mode implementation and integrated database engine deliver unmatched PC LAN performance. It's NetBIOS and TCP/IP compatible, runs all DOS-based applications and can be configured for Ethernet, Token-Ring and ARCnet.

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Call or write for additional information: DSC Communications Corporation, P.O. Box 110940, Campbell, CA 95011. **(800) BUY NEXOS.**

DSC Communications Corporation

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CIRCLE 349 ON READER SERVICE CARD

Fax Boards: Compatibility Chart

Because a communications standard can turn out to be less standardized than you might expect, PC Labs tested the compatibility of PC fax boards that are touted as adhering to the Group 3 standard. Using two fax machines, we tried sending a two-page message from each board reviewed to each of the other boards. We also tested each fax board for compatibility with two of the more-commonly-used stand-alone fax machines, the Canon FaxPhone 20 and the Ricoh FAX60. The sending systems are listed along the top of this chart; the receiving systems are listed down the side.

For the purposes of this test, we accepted as a "pass" any transmission that succeeded in transferring both pages within three trials. Failures ranged from cases where two packages could not establish communications to cases where the packages could transmit the first page but lost the second. Most disconcerting were those failures that were recorded in the logs of both packages as successes—without any file being produced on the receiving side.

The compatibility tests showed expected anomalies. Some pairs of packages (such as the ImageCard and The Complete Fax/9600) won't talk to each other at all. Others (such as the JT-Fax 9600 and The Complete Fax/9600) will transmit data only in one direction.

The point of this exercise is not only to demonstrate the compatibility of each board with the others, but to show how much variation there is in the manufacturers' interpretations of the Group 3 standard. This is true for fax machines as well as fax boards.

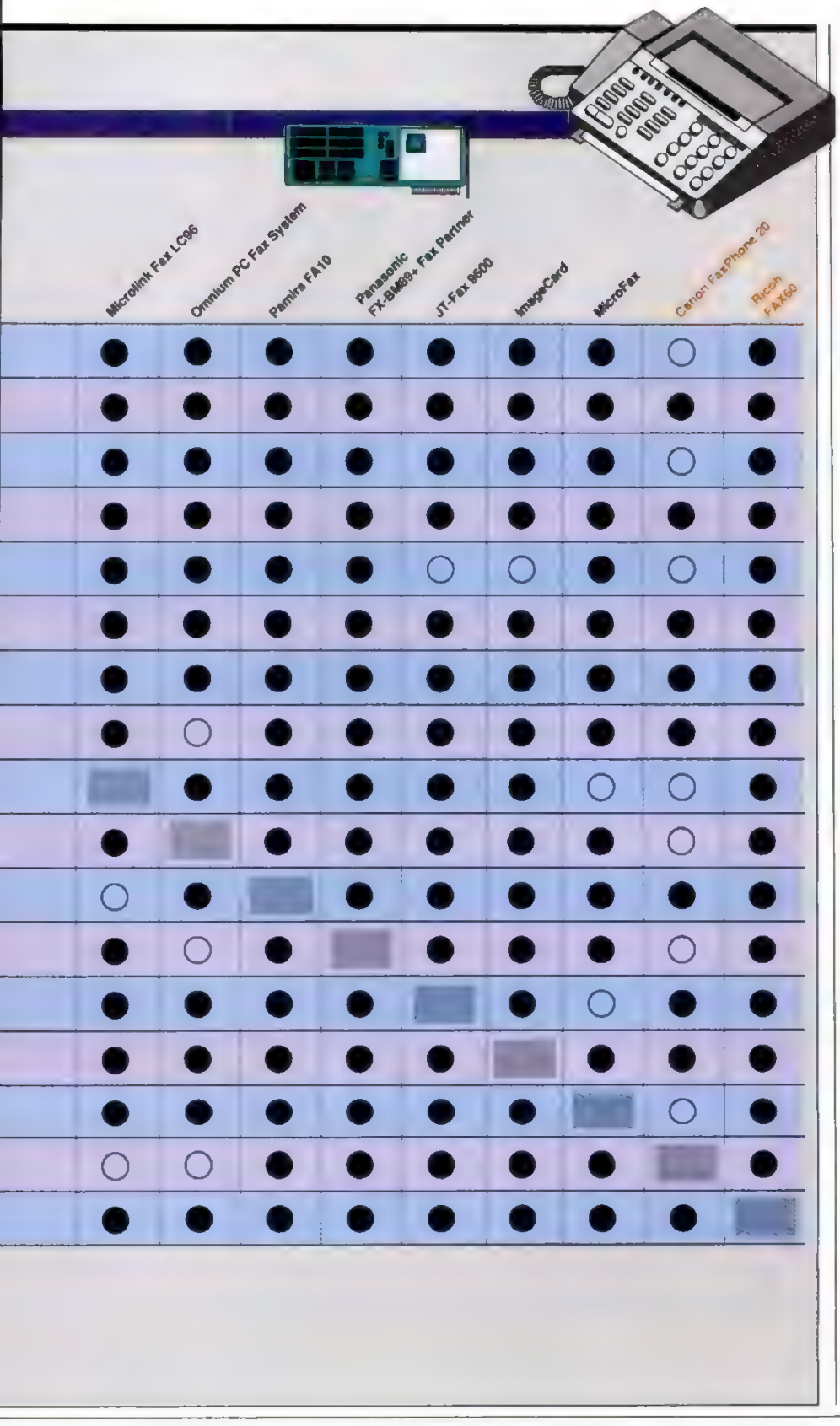
As these compatibility tests show, the fax industry has yet to hammer out the details of the Group 3 standard. This is partly owing to the relative newness of the standard; moreover, there is no one dominant manufacturer the rest of the industry can follow. As a result, you cannot be absolutely sure that any given fax package can talk to any other—be it a PC-based system or a stand-alone machine.



RECEIVING	SENDING: SMARTFAXplus	AT&T Fax Connection	FaxMail 96	Brother IntelliFAX	The Complete Fax/9600	Facsimile Pack	GammaFax	Connection CoProcessor
SMARTFAXplus	■	●	●	●	●	●	●	○
AT&T Fax Connection	●	■	●	●	○	●	●	●
FaxMail 96	●	●	■	●	●	○	●	●
Brother IntelliFAX	●	●	●	■	●	●	●	●
The Complete Fax/9600	●	○	●	●	■	●	●	●
Facsimile Pack	●	●	●	●	●	■	●	●
GammaFax	●	○	●	●	●	●	■	●
Connection CoProcessor	●	○	●	●	●	●	○	■
Microlink Fax LC96	●	●	●	●	○	●	●	○
Omnimo PC Fax System	●	●	●	●	●	●	●	●
Pentre FA10	●	●	●	●	●	●	●	●
Panasonic FX-EM96+ Fax Partner	●	●	●	●	●	●	●	●
JT-Fax 9600	●	●	●	●	●	●	●	●
ImageCard	●	●	●	●	○	●	●	●
MicroFax	●	●	●	●	●	●	●	●
Canon FaxPhone 20	●	●	●	●	●	●	●	●
Ricoh FAX60	●	●	●	●	●	●	●	●

● —Yes ○ —No

■ —Not applicable: the product was not tested for compatibility with itself.



in more detailed—and more accurate—error reporting than is the case with most fax boards. Ricoh also boasts that the package has been tested with more than 100 machines and is compatible with them all.

The ImageCard was designed as a broadcasting tool for high-volume fax users. A remote-control feature will let you send a file to the ImageCard from a fax machine, then use the ImageCard to distribute the fax to other locations.

A related feature is the $395 *ImageNet* option. With *ImageNet* running on the PC with ImageCard and on a remote PC, you

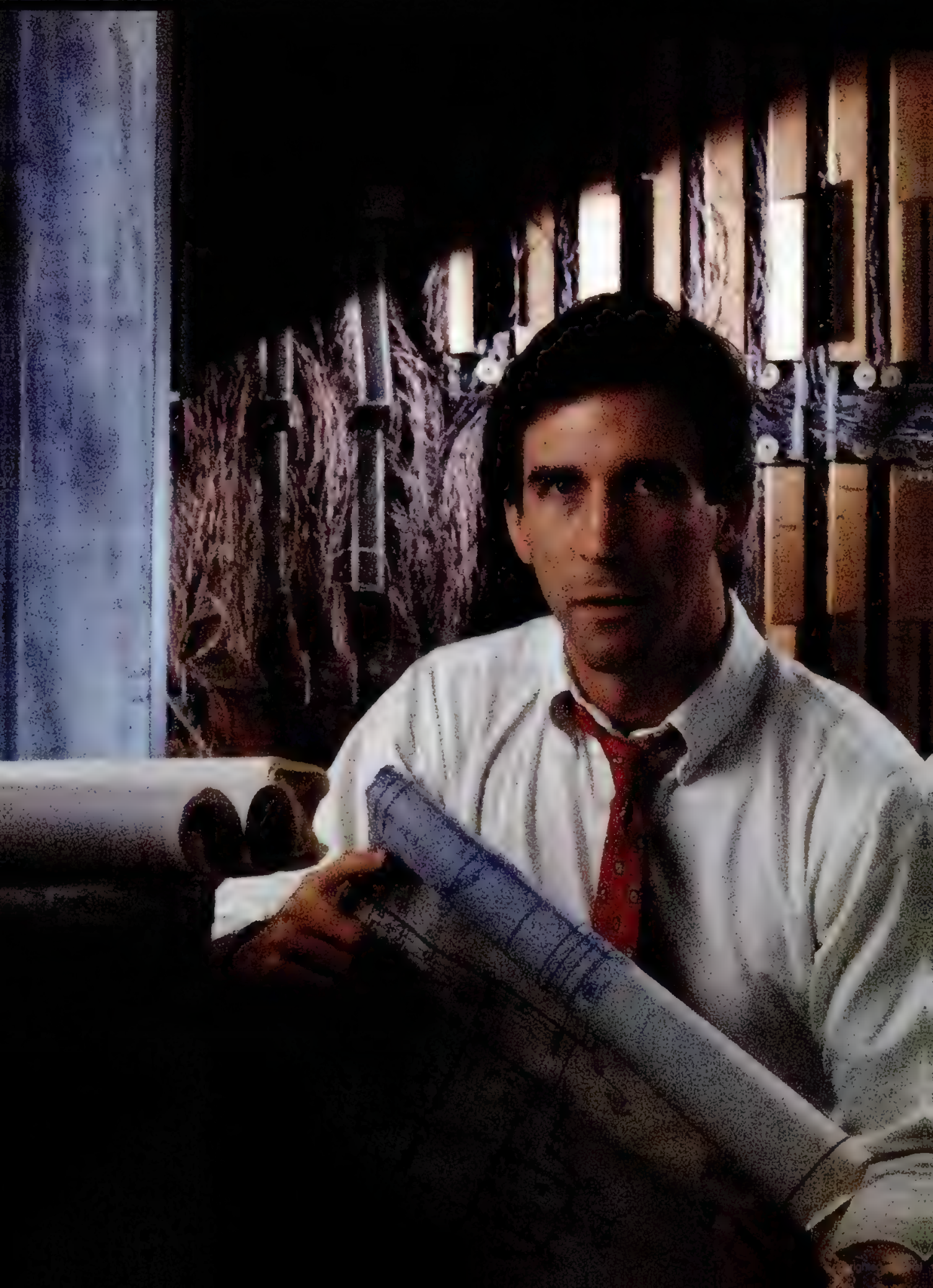
■

A remote-control feature will let you send a fax to your computer, then use the ImageCard to distribute the fax to other locations.

■

can call the ImageCard from the remote location and send it a fax through a standard modem. (The modem is not included in the fax package.) The ImageCard can then resend the fax. In short, *ImageNet* gives fax capabilities to the remote PC without needing a fax board. (The *ImageNet* software and remote operations feature were not tested for this review.)

IMPROVEMENTS ON THE WAY The broadcast features in the ImageCard package stem from Ricoh's background as a fax machine manufacturer. Alas, Ricoh's background shows elsewhere as well. In particular, the software was designed with little thought for the PC market, resulting in a limited and often clumsy package. On the plus side, an improved version of the software and documentation is in the works. Because the software is in beta test, this review is necessarily based on the older, 1.22 release. However, Ricoh also sup-



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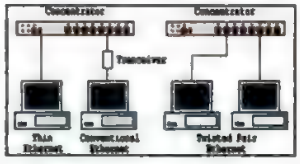
Now you can install your network using existing phone wire, and get Ethernet performance, too.

Introducing the total solution for Ethernet network performance without the cost of cumbersome cabling. Western Digital's Preference™ family of network products makes it easier and more economical than ever to create new networks and expand existing coaxial Ethernet systems, too—using wire that's already in the wall.

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Our Twisted Pair products provide flexibility for new and existing installations.

A Preference for Complete Solutions.

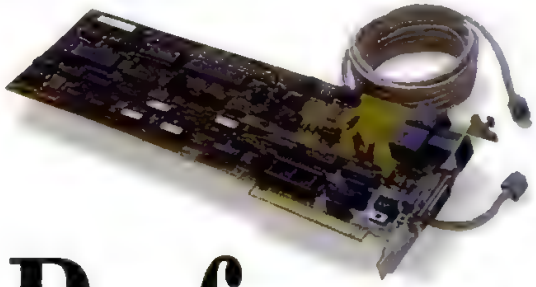
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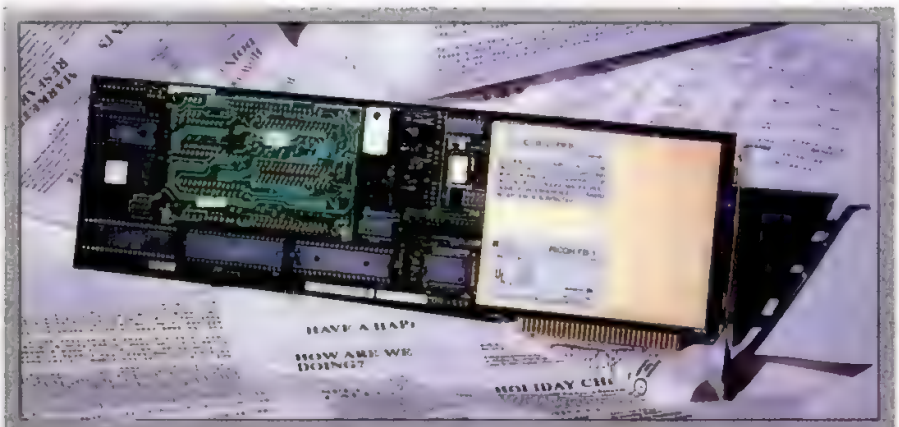


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CIRCLE 239 ON READER SERVICE CARD



The full-length 9,600-bps board that is part of the $1,175 Ricoh ImageCard package sports a microprocessor to handle background operations and a proprietary chip that decompresses each line of a received fax, looks at the error code, and recompresses it before saving the data to disk. This results in more detailed—and more accurate—error reporting than with most fax boards.

plied a beta release of Version 2.03.

In both versions, the master menu offers three choices for fax transmission. The Telephone Network choice includes options to send a fax, receive a fax, and display an image. Unfortunately, the software module is modeled too closely on a fax machine. For example, if a transmission fails, you have to start over again, reentering the file to send and the phone number to send to.

■

The Ricoh ImageCard is by far the most expensive fax package reviewed here.

■

Some limitations are handled in the main menu's Document Distribution choice. This module contains a phone book for individuals and groups, with up to 200 numbers per group. It will also let you schedule faxes and will automatically retry when a transmission fails. Oddly, for a package that concentrates on broadcast functions, it is limited to about 250 scheduled transmissions, with a transmission defined as one image file going to one phone number.

The third choice on the main menu lets you automatically negotiate connections with a data network—be it Tymnet or a dedicated private data line—so you can send faxes over that network.

The documentation gets good marks for organization but is written in a jargon-laden technostyle that will never use one word where five will do. Worse, it is printed in landscape orientation, so that reading the manual is clumsier than it has to be. According to a Ricoh spokesman, the manual for Version 2.03 will be completely rewritten and will be printed in portrait orientation.

Missing from this package is any direct support for scanners. Version 2.03 will include scanner support, but only for the Ricoh IS10, IS30, SS30, RS320, and compatibles—and even then without a dithering feature. Printer support is similarly weak, with choices for only the Xerox 4045, HP LaserJet Plus, IBM, Epson, Okidata 92/93, and AST Turbo printers.

Finally, the Ricoh ImageCard is by far the most expensive fax package reviewed here. At $1,175, it costs almost 20 percent more than the next most expensive package. According to a Ricoh spokesman, the price will drop significantly with Version 2.03; but the new price has not been determined as of this writing.

Regardless of price, the ImageCard is of little interest to those who simply want to add a fax capability to their PCs. But for those who can make use of the broadcasting capability, the data network feature, or both, the Ricoh ImageCard is an interesting possibility.—**M. David Stone**

XEROX IMAGING SYSTEMS/DATACOPY

MicroFax

When we last reviewed the MicroFax, its manufacturer was an independent. Now it's the Datacopy products group of Xerox Imaging Systems. Fortunately for the MicroFax, this new business arrangement didn't result in the product's getting lost in the bureaucracy of a large organization: Version 2.0 of the $695 system brings new and enhanced features to an already strong product.

The MicroFax is a full-sized 9,600-bit-per-second fax board with an on-board 1,200-bps Hayes-compatible modem. It should be noted, however, that no modem communications software is included, so you'll need to supply your own. All standard fax operations are controlled with the MicroFax software.

The MicroFax's upgrade path, which is taken care of through software, reflects the product's maturity. As the vendor adds new features, all you'll need to do is get a new disk; because you won't have to re-

PC MAGAZINE FACT FILE

MicroFax
Xerox Imaging Systems/Datacopy
1215 Terra Bella Ave.
Mountain View, CA 94043
(415) 965-7900
List Price: $695
Requires: 512K RAM; hard disk; IBM PC, XT, AT, any PS/2 or compatible; CGA, EGA, VGA, Hercules, or many other graphics cards for viewing; DOS 2.0 or later.
In Short: Easy to install and use, the Datacopy MicroFax is a bargain with its on-board 1,200-bps modem and full set of features. Its only limitation is its inability to handle gray-scale transmissions, except through an approximation technique called dithering.

CIRCLE 410 ON READER SERVICE CARD

A Few Words From The World's Most Celebrated Graphics Software.

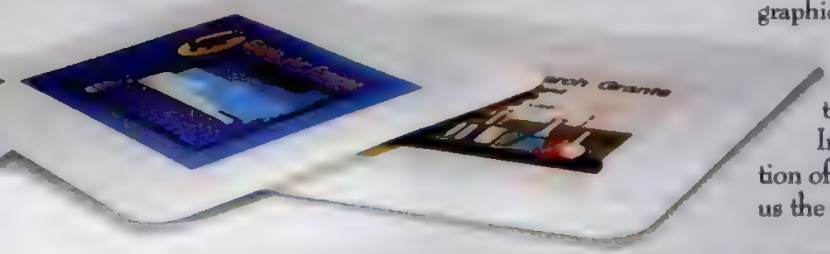




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Actually it must have been all those things and more. Otherwise why would PC Magazine call Harvard Graphics "the de facto standard" software for business graphics?

Of course, the experts aren't the only ones who favor Harvard Graphics. In fact, with its growing popularity, Harvard Graphics has become the number-one selling business graphics software.



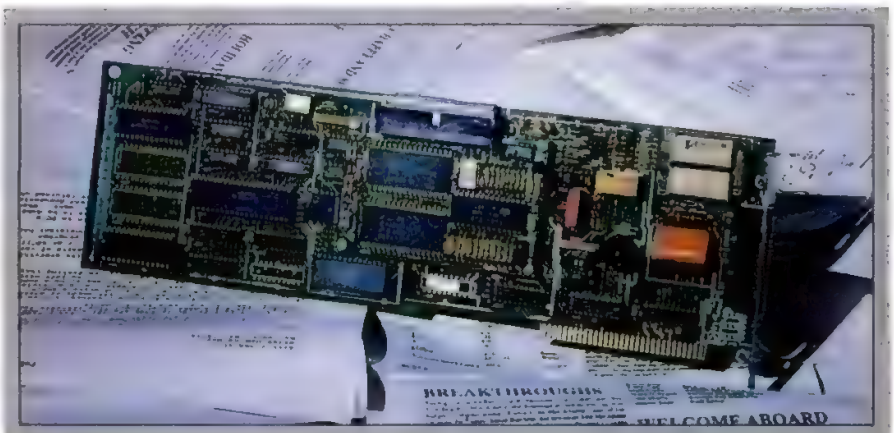
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Although you'll have to supply your own communications software, the full-length 9,600-bps board that is part of the $695 MicroFax system from the Datacopy products group of Xerox Imaging Systems has a built-in 1,200-bps Hayes-compatible modem.

place the board, you'll save money and time.

A new version of the software, which should be available by this time, will automate installation. Even so, installing the current version is a snap, merely requiring you to answer a series of simple on-screen questions.

MEMORY-SAVING SOFTWARE MicroFax software isn't a TSR, but it can send and receive in the background. The resident program requires only a frugal 4K of memory—a nice switch from some memory-hungry TSRs. The background feature worked reasonably well in our error-handling tests, continuing to receive a file when asked to log on to an empty drive.

If the computer was already trying to read an empty drive or pausing a screen, however, an incoming fax call would not connect. A call coming in while the computer was printing out a file caused no problems for the MicroFax. The program does not protect against a warm reboot, though, which means that an incoming fax will be terminated if the Ctrl-Alt-Del keystroke combination is used during a transmission. In all cases we were sending faxes from one MicroFax to another, and the sending program rescheduled unsuccessful connections or incomplete transmissions for a later time.

The MicroFax user interface is menu driven and simple. The program is divided into three basic sections: Commands, Logs and Files, and Set Up. You select any one of these sections from a horizontal-bar menu. After you've made a selection, a pull-down menu appears with more specific subcommands or program functions. All operations are accessed through menus; the software does not offer hotkeys.

BEYOND THE BASICS Besides standard fax operations, the MicroFax gives you several extra capabilities. You can capture both text and graphics screens for either immediate or later transmission, and you can also transmit originals directly from a scanner and from ASCII and graphics files. MicroFax works with .PCX, GEM, TIFF, .IMG, and *AutoCAD* graphics files. But you'll have to work with those files as they are, since there are no built-in graphics editing capabilities. Both ASCII and graphics files are converted to fax format prior to transmission, with the conversion process done in the foreground.

The MicroFax also lets you set up phone books and schedule calls for later transmission. The software maintains logs of all transactions, which can be printed as well as displayed. Although the MicroFax software does not offer the ability to handle gray scales (except by dithering), it does let you select between normal- and high-resolution modes and normal and compressed fonts.

There's no automatic cover-page feature, but there is a way for you to include a document header with your transmission. For manual calling, you can switch between voice and fax transmission modes both before and after sending a fax. Furthermore, the MicroFax supports Group 3 polling and turnaround polling.

The MicroFax works with all standalone fax machines, except for one obscure Fujitsu machine, according to the vendor. We had no problems working with two fax machines at PC Labs. In our performance tests, we used the MicroFax with the Datacopy 730GS scanner; it can be set to work with all other Datacopy scanners as well as the IBM 3117, HP ScanJet, AT&T Overview, Canon IX-12, Microtek MS-300A, Panasonic FX-RS505, Princeton LS300A, Shape's ShapeScan SS-240, Tall Tree Systems' Jlaser scanner, and all Ricoh scanners. The MicroFax has drivers for most printers, including those that work with the PostScript page description language. Sample output produced on our HP LaserJet Plus looked fine, with no aspect ratio distortion. The

■

The MicroFax's upgrade path is taken care of through software. As the vendor adds new features, all you'll need is a new disk.

■

MicroFax board can also transmit oversized sheets of paper, handling our 28-inch test sample without a hitch. (However, since the accompanying software can't handle gray scales, the transmitted photo was reproduced in black and white.)

Considering that other fax boards with similar features that include a modem typically cost a couple of hundred dollars more, the Datacopy MicroFax is a good buy for most users. It can't handle gray

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■ FAX SYSTEMS

PC MAGAZINE EDITOR'S CHOICE

- **Connection CoProcessor**
- **JT-Fax 9600**

In PC Magazine*'s last roundup of PC-compatible fax systems, we singled out several products—Quadram's JT-Fax, GammaLink's GammaFax, Datacopy's MicroFax, and Panasonic's Fax Partner—for honorable mention, but we didn't award any one board an Editor's Choice for a simple reason: not one of the packages was a fully finished product. That situation, we're happy to report, has changed, and there are now several packages that we can wholeheartedly recommend.*

If you want a package that maintains the ease of use of a fax machine while taking advantage of the capabilities of a PC, you have at least two good choices. The $995 Intel PCEO Connection CoProcessor offers an easy-to-use menu structure, free technical support, excellent error handling, and a 5-year replacement warranty. Missing from the package is the ability to capture printer output from an application to send as a fax. However, the Connection CoProcessor is the first piece of hardware to support CAS, and if the industry adopts it, the board will be able to send faxes from any program with a built-in CAS interface.

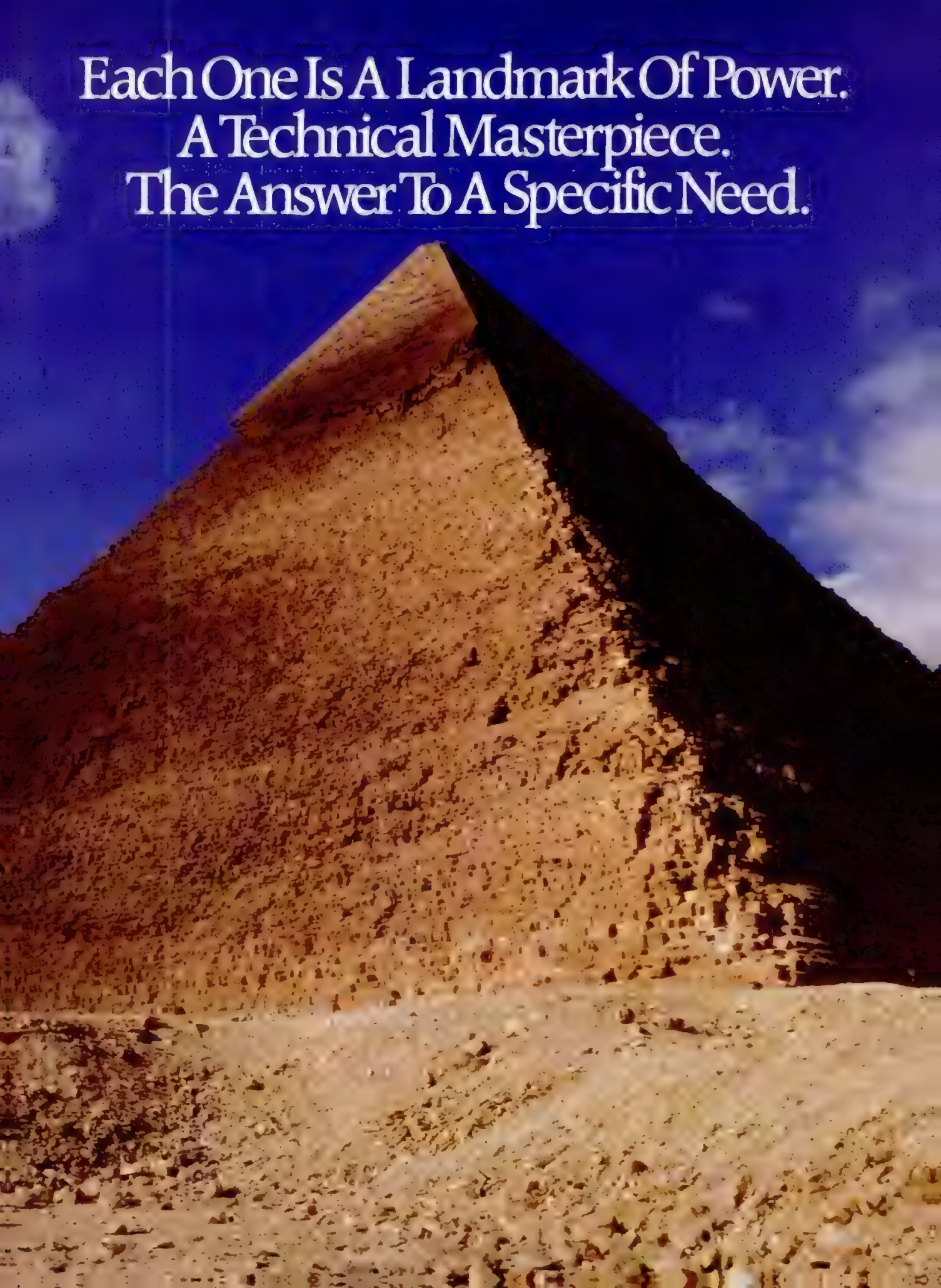
Quadram's JT-Fax 9600 is another good choice. It sports a simple menu structure, somewhat better-than-average speeds on PC Labs' timing tests, and a price of $795. Most important, this version remedies two drawbacks that kept the original JT-Fax from earning an Editor's Choice designation: its limitation to 4,800-bps operation, and a TSR feature that popped up in the middle of other applications when you sent or received faxes.

An honorable mention goes to The Complete Fax/9600, from The Complete PC. The $699 package has almost as well designed a menu structure as the Connection CoProcessor and adds the ability to send faxes by capturing printer output. Unfortunately, its speed is on the low side of average, but it is a solid product, well worth your attention.

An additional honorable mention goes to the AT&T Fax Connection, which was the fastest performer on two of the three PC Labs benchmark tests. As tested, the $995 board takes its marching orders only from the DOS command line, a method that may be intimidating to novices. Of course, for an additional $295 (or an extra $200, if purchased with the board), you can buy PagePower*, an integrated set of fax, scan, draw, and communications programs that runs under* Microsoft Windows *and makes the system more user friendly. But that extra cost brings the price of the Fax Connection well into the range of fax machines, which is something you should consider before you take the plunge.*

scales and its modem can't exceed the speed of 1,200 bps, but the MicroFax's fine background operation and easy menu operation make it a good choice for general use.—**Bruce Brown**

John Britton is a writer and computer consultant living in New York. Bruce Brown is a frequent contributor to PC Magazine. *Robert Kendall is a New Jersey–based free-lance writer and editor who specializes in computers. Edward Mendelson, Robin Raskin, and M. David Stone are contributing editors of* PC Magazine.


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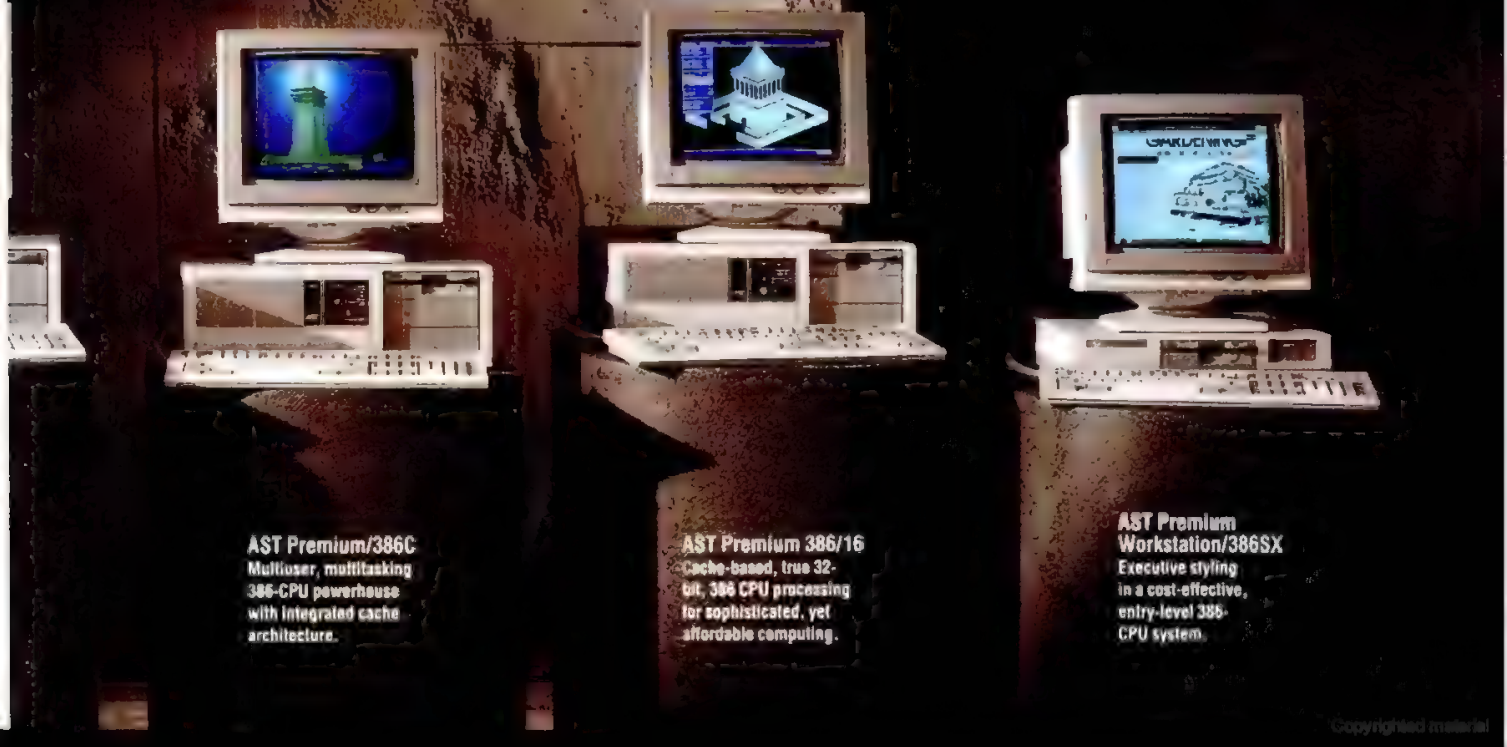
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DOS-under-Unix software offers PC users a way to merge the strengths of two operating systems, affording them more power and flexibility than either system could offer independently.

DOS UNDER UNIX

If one operating system has profited from the confusion that OS/2's arrival has introduced in the PC market, it's Unix. For as PC users take a hard look at whether OS/2 is the answer to dealing with such thorny problems as multitasking, they are also remembering that Unix has offered that advanced capability and a whole lot more on mainframes and minicomputers since the early 1970s. And now that the advent of cheap 80386 32-bit processing power makes the PC a legitimate hardware platform for Unix (and also one that is similar to the minicomputers on which Unix was developed), Unix has become a viable, attractive option for people who are thinking about upgrading from DOS to a different and more powerful operating system.

VIRTUAL 8086 MODE: THE KEY TO RUNNING MULTIPLE DOS SESSIONS ON A 386 MACHINE

Virtual 8086 mode—a mapped, protected operating mode of the 80386 chip—allows a host 80386 machine to imitate an ordinary PC nimbly and convincingly.

Despite its faults, the 8086 chip has proven to be the most successful platform for business applications. That's why, when Intel designed successor products, it made sure to provide for strict backward compatibility with the family patriarch.

When power is applied and an 80286 or 80386 machine comes to life, it starts out in the guise of a humble 8086; thus it is an acceptable hardware platform for ordinary 8086 applications. In this instance, the 286 or 386 runs in real mode, but both microprocessors can support protected modes as well. Protected mode facilitates running several tasks concurrently because it permits isolating each task. Although the 286 has a protected mode of operation, it retains the 8086's 16-bit architecture. The 386 removes the 16-bit limitation in protected mode, and it also has virtual 8086 mode, which is used by DOS-under-Unix software.

When you run a 286 in protected mode, you can utilize up to 16MB of memory (instead of the 1MB potentially addressed by the 8086), and you get memory management, which allows the operating system to institute security measures. Unfortunately, there is no simple route that an advanced operating system like OS/2 or Unix can take back to 8086 real mode. OS/2 is able to switch between 286 protected mode and 8086 real mode. But to do so, OS/2 must go through the motions of restarting your machine, which means that you are limited to one real-mode process at a time.

When a 386 shifts into protected mode, the potential memory you can address goes up to 4 gigabytes. The internal architecture of the CPU goes to 32 bits (which makes it easier to work with large programs and large data sets), and you also get memory management and virtual 8086 mode.

A mapped protected mode of the 386 processor, virtual 8086 mode is essentially an illusion. It makes use of some of the attributes of both real and protected modes, allowing your DOS-under-Unix program to set up a PC-like environment from within protected mode. An application that runs in this environment will think it is running in an ordinary 8086-based PC; little does it know that a powerful 386 is pulling the strings to make everything work. For example, many DOS programs routinely write characters to the display screen addresses of the PC. When these programs run in virtual 8086 mode, they still write to those addresses, but the addresses no longer refer to the screen. It's up to the 386 to decide if and when that information should be displayed on the screen of the computer.

Using virtual 8086 instead of real mode gives you much more flexibility. If a 386 machine has 6MB of memory, for example, it can take the top half of that memory and set up three independent virtual 8086 environments of 1MB each, in which different DOS sessions can be run. Each environment is isolated, so that an ill-behaved application in one can't corrupt the others. Of course, from Unix's perspective, each of these three environments is simply a task that should be allocated time slices, just like all the other active tasks in the system. In addition, virtual 8086 environments can be swapped out to disk so that you can run more than will simultaneously fit in memory. This is why the Unix system,

Of course, people who have worked in organizations where DOS and Unix have been coexisting on different hardware platforms have known all this for some time now. What they might not know is that the 386 chip, through its virtual 8086 mode, offers them a way to bring the power of DOS applications to the Unix world while at the same time bringing much of the power of Unix to the DOS world, without sacrificing most of the amenities exclusive to each.

The virtual 8086 mode makes it possible to multitask multiple DOS sessions under Unix on a single 386 machine. In this arrangement, each DOS application runs in its own virtual machine. In its ability to handle multiple DOS sessions as well as multiple users, Unix goes OS/2 one better: OS/2, a single-user, multitasking operating system, does not support the virtual 8086 mode of the 386 microprocessor. OS/2 can therefore run DOS software in its compatibility box, but only one session at a time. (See the sidebar "Virtual 8086 Mode: The Key to Running Multiple DOS Sessions on a 386 Machine.")

Several software products, known as DOS-under-Unix environments, make use of the 386's virtual 8086 mode to couple DOS and Unix. Reviewed here are two of these products. The first is *VP/ix*, a collaborative venture of Interactive Systems Corp., a long-time Unix vendor, and Phoenix Technologies, known for its BIOS compatibility software; the second is *Merge 386* from Locus Computing Corp., a company known for its DOS-to-Unix bridge products (in particular, *PC-Interface*, a DOS-to-Unix networking product). Both *VP/ix* and *Merge 386* were first released in 1987 and have undergone one

which uses virtual 8086 mode for DOS applications, can run several concurrently, while OS/2, which uses 8086 real mode to run DOS software, can handle only one DOS task at a time.

VP/ix and *Merge 386* set up a virtual 8086 environment that duplicates the hardware/software environment of an ordinary PC, as far as possible, with the effect that DOS and most DOS applications are fooled. For example, the screen buffer and the BIOS software must be where they are expected, the BIOS level interrupts and services must work as expected, and the communication ports must function correctly. The environment must be convincing enough that DOS can load and operate normally, because *VP/ix* and *Merge 386* actually run DOS; they don't simulate it.

As it stands, both products fall short of precisely imitating every aspect of the PC's hardware, and both have problems handling software that is ultrasensitive to timing. As a result, they won't be able to run every DOS application under the sun—just the vast majority.

—Kaare Christian

major revision each. Although the two products are more alike today than they were when they were first released, *VP/ix* is directed toward users who require convenient DOS-under-Unix capability, while *Merge 386* is targeted toward users whose systems are burdened with heavy multiuser loads where performance and configurability are important.

SECONDARY VENDORS Both *VP/ix* and *Merge 386* are available from many secondary vendors, some of whom add related features that enhance these DOS-



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■ DOS UNDER UNIX

under-Unix environments. Some offer DOS-under-Unix products designed for specific hardware platforms. Others offer related networking products, the capability to mount DOS file systems onto the Unix file system, and compatibility with the emerging X Window environment—a graphical user interface developed at Massachusetts Institute of Technology that adds windows and graphics extensions to the Unix operating system.

Because of the similarities between *VP/ix* and *Merge 386* and their variants, we decided to test the primary products in just one Unix environment: *VP/ix* was tested under Interactive Systems' own Unix environment, 386/ix; *Merge 386* was tested under Bell Technologies' Unix System V, Release 3.0. The testing and evaluation focused on the DOS-under-Unix products, not on the host Unix environment, although the performance of the host Unix software does have an important impact on file I/O operations. The performance of computationally intensive operations, which are more internal to the virtual 8086 environment, is determined by *VP/ix* and *Merge 386*.

Of all the vendors that have enhanced *VP/ix*, Sun Microsystems has probably done the most customization. Sun Microsystems made extensive changes to *VP/ix* so that it can work smoothly with *DOS Windows*, a windowing environment that is bundled with the Sun 386i computer. (For this reason, the review of *VP/ix* in this issue has only limited applicability to those considering the Sun product.) Sun Microsystems' version of *VP/ix*, which comes with both the Sun 386i/150 and Sun 386i/250, allows DOS text or graphics applications to run in windows on either machine's large, high-resolution screen; allows cutting and pasting of data between windows; comes with Sun Organizer, an icon-based interface to both Unix and DOS software and files; lets you dynamically attach and detach nonshareable devices, such as floppy disk drives and communications ports; lets you run selected DOS networking products in the DOS environment; includes a *Microsoft Windows* 2.01 driver so that *Windows* can use the full screen; and allows for per-drive file sharing and per-drive file and record locking over the network. The base prices of the Sun 386i/150 and 386i/250 are $8,490 and $12,740, respectively.

AT&T, whose Bell Laboratories developed Unix in the early 1970s, has a version of *VP/ix* called *AT&T Simul-Task 386*, Version 2.0, which runs under Unix System V/386, Release 3.2, primarily on AT&T's WorkGroup System (WGS) 6386 and WGS 6386E. Among its enhancements are its ability to run DOS CGA (Color/Graphics Adapter) and text applications in console X11 Windows (X11 Windows is the latest release of the X Window environment) and DOS EGA (Enhanced Graphics Adapter) applications in full-screen X11 Windows. In addition, its base Unix menuing environment simplifies DOS access. *Simul-Task 386*, Version 2.0, costs $695 for an unlimited license, and Unix System V/386, Release 3.2, costs $795 for an unlimited license.

■ The 386, through its virtual 8086 mode, offers a way to bring the power of DOS to the Unix environment.

The Santa Cruz Operation, which makes SCO Xenix, one of the most popular Unix variants, offers *SCO VP/ix* running under SCO Xenix 386 (Versions 2.2 and 2.3). Its enhancements include commands that let you access files on DOS floppy disks and partitions; support for SunRiver's graphics terminal, the PS/2 series of computers, and the PS/2 mouse; menu-driven system administration; the ability to run DOS software in the X Window environment; and the ability to integrate standalone DOS machines and Xenix hosts through Xenix-Net. *SCO VP/ix* has a price of $495 for a one- to two-user license and $995 for an unlimited license; SCO Xenix 386 costs $595 for a one- to two-user license and $795 for an unlimited license.

Like *VP/ix*, *Merge 386* has also seen its share of enhancements. For example,



QNX vs. OS/2 UNIX

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ARCHITECTURE If the micro world were not so varied, QNX would not be so successful. After all, it is the operating system which enhances or limits the potential capabilities of applications. QNX owes its success (over 75,000 systems sold since 1982) to the tremendous power and flexibility provided by its modular architecture.

Based on message-passing, QNX is radically more innovative than UNIX or OS/2. Written by a small team of dedicated designers, it provides a fully integrated multi-user, multi-tasking, networked operating system in a lean 148K. By comparison, both OS/2 and UNIX, written by many hands, are huge and cumbersome. Both are examples of a monolithic operating system design fashionable over 20 years ago.

MULTI-USER OS/2 is multi-tasking but NOT multi-user. For OS/2, this inherent deficiency is a serious handicap for terminal and remote access. QNX is both multi-tasking AND multi-user, allowing up to 32 terminals and modems to connect to any computer.

INTEGRATED NETWORKING Neither UNIX nor OS/2 can provide integrated networking. With truly distributed processing and resource sharing, QNX makes all resources (processors, disks, printers and modems anywhere on the network) available to any user. Systems may be single computers, or, by simply adding micros without changes to user software, they can grow to large transparent multiprocessor environments. QNX is the mainframe you build micro by micro.

PC's, AT's and PS/2's OS/2 and UNIX severely restrict hardware that can be used: you must replace all your PC's with AT's. In contrast, QNX runs superbly on PC's and literally soars on AT's and PS/2's. You can run your unmodified QNX applications on any mix of machines, either standalone or in a QNX local area network, in real mode on PC's or in protected mode on AT's. Only QNX lets you run multi-user/multi-tasking with networking on all classes of machines.

REAL TIME QNX real-time performance leaves both OS/2 and UNIX wallowing at the gate. In fact, QNX is in use at thousands of real-time sites, right now.

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QNX

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Prime Computer offers *Merge 386* under its own implementation of Unix System V, Release 3.0, running on Prime's EXL Series 386. A fee of $1,800 will buy you an unlimited license for this DOS-under-Unix program, which offers synergy with *PC-Interface* and supports the PT250 terminal. Convergent Technologies distributes *Merge 386* under CTIX/386, a version of Unix System V, Release 3.0, running on the Server PC series. An unlimited license costs $1,100; enhancements include a PC-compatible hardware interface. Bell Technologies' *Merge 386* under Unix System V/386, Release 3.0 or 3.2, supports the Blit series of graphics engines and such networking protocols as TCP/IP. A one- to two-user license for Bell's *Merge 386* costs $295, and an unlimited license costs $795. A one- to two-user license for Unix System V/386, Release 3.0, costs $190 ($295 for Release 3.2), and an unlimited license costs $290 ($795 for Release 3.2).

■ In Unix, a true copy of DOS runs just as it does on a standard PC, so even an ill-behaved program like a TSR should operate normally.

Microport Systems offers *DOS Merge 386*, which runs under Microport's Unix variant, Microport System V/386, Release 3.0e. Highly compatible with Locus's original *Merge 386* program, Microport's *DOS Merge 386* has an advanced driver set as well as doscp, dosdir, and doscat utilities to access DOS diskettes and partitions. *DOS Merge 386* costs $399 for a one- to two-user license and $499 for an unlimited license. Microport System V/386, Version 3.0e, costs $299 for a one- to two-user license and $598 for an unlimited license.

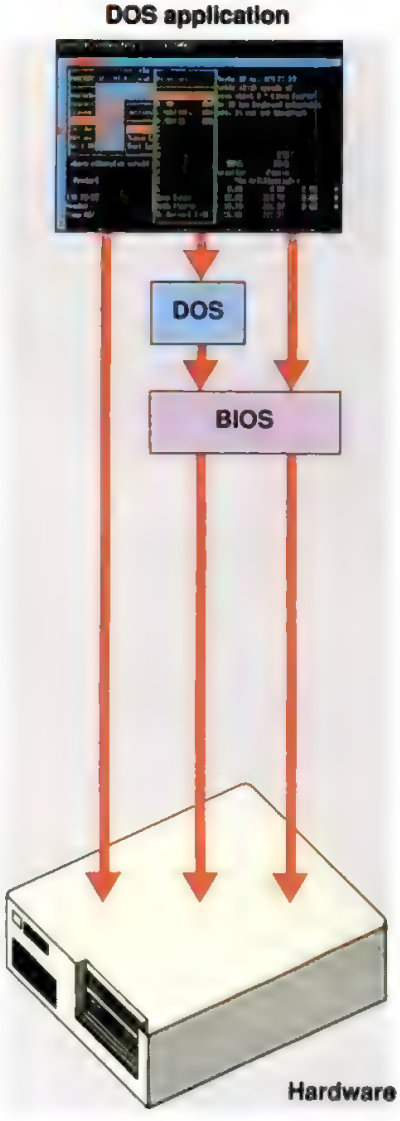
Unisys markets *Merge 386* under Unisys System V (based on Unix System V, Release 3.0), running on the Unisys 6000/50 system. An unlimited license for this program costs $1,000. Unisys's offering provides synergy with *PC-Interface;* supports the Unisys UVT 1224G terminal, which consists of a PC-compatible screen and keyboard; and comes with OFIS Ensemble, a program that ensures easy access to the best environment for a particular function, such as Unix for sending mail or DOS for word processing.

FEATURES IN COMMON Enhancements aside, both *VP/ix* and *Merge 386* take a similar approach to supplying a DOS-under-Unix environment. With each, the standard Unix environment is still there, with all its commands, capabilities, and complexity. Each product adds one basic command to the Unix repertoire—the command to start up a DOS environment, which is much like booting DOS on a standard PC and takes about as long as a warm reboot. And, of course, both products use the 386 processor's virtual 8086 mode to create the DOS-under-Unix environment, which mimics the hardware architecture of a standard PC.

Within that environment, a true copy of DOS executes just as it does on a standard PC, which means that even ill-behaved programs like TSRs should operate normally. A single DOS-under-Unix session will run at a speed comparable to that of DOS running on a 386 machine without Unix. When several DOS-under-Unix sessions are running, you'll see a certain amount of performance degradation. But you will usually be able to maintain AT-level or better performance for each session.

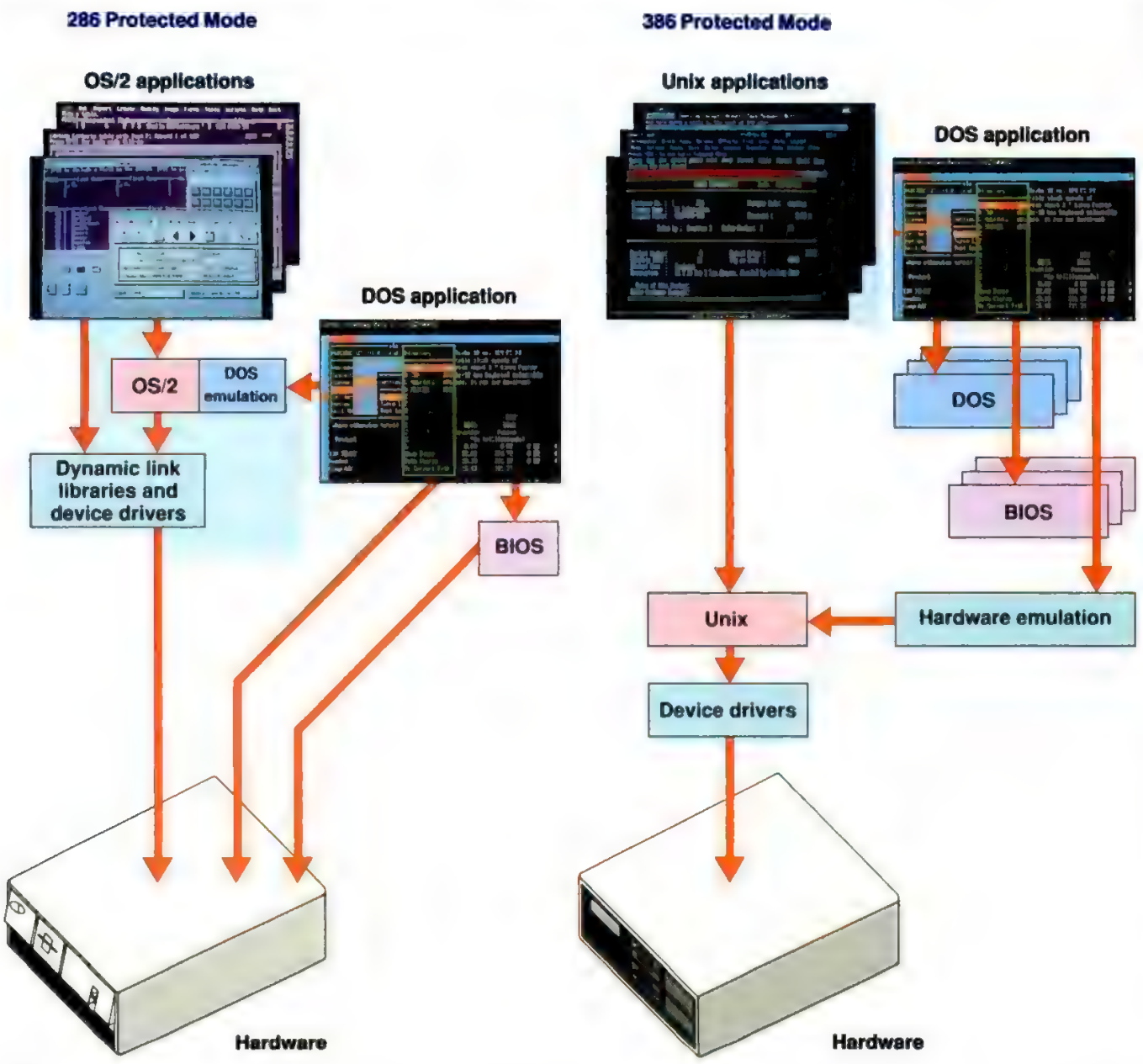
From within the DOS environment, you can enter DOS commands—anything from DIR or TYPE to running your favorite application program. In addition, both DOS-under-Unix products will automatically fire up the right environment to execute whatever command you enter. For example, if you enter Unix's ps (process status) command from the DOS environment, the system will temporarily switch back to Unix, run the ps command, and then switch back to DOS. Similarly, you can enter DOS commands from within the Unix environment. The only drawback to doing so is that your start-up time will be slightly longer than if you were operating in the right environment to start with.

Different Operating Systems, Different Methods



The DOS Environment

Whether it's running on an 80286 or 80386 machine, DOS operates the same way. As shown here, the BIOS (Basic Input/Output System) handles the lowest level of services, DOS handles an intermediate level, and the application program is what the user sees. Because there is no memory protection, an application can reach past DOS to access the BIOS directly, or it can even lunge past both to access the hardware.



The OS/2 Environment

This diagram shows how OS/2 juggles protected-mode applications plus a single DOS application running in 8086 real mode. OS/2 and the applications written for it operate in the protected mode of the 80286, shown in blue, while the DOS software operates in 8086 real mode. This arrangement allows OS/2 to operate on both 286- and 386-based machines.

The Unix Environment

The Unix approach, which operates only on 80386-based machines, uses virtual 8086 mode for the DOS sessions. The Unix system and Unix applications operate in the protected mode of the 80386, shown in blue. The role of *VP/ix* and *Merge 386* is to create the proper virtual 8086 mode, which involves taking care of two basic chores: emulating the standard hardware that exists on PCs—such as the disk, the keyboard, and the display—and furnishing the BIOS software that DOS and its applications expect. Within each specially crafted virtual 8086 environment, a copy of DOS and a standard application can run as if they were running on an ordinary PC.

Another feature common to both programs is the ability to run DOS sessions from a terminal. On standard serial terminals you are limited to running text software; any program that runs on an IBM Monochrome Display Adapter (MDA) should work fine on a terminal. Screen redrawing speeds are slower than for the PC's traditional memory-mapped video adapters, but for many applications a serial terminal works fine.

Both *Merge 386* and *VP/ix* support multiple console sessions; hence you can interact with several separate sessions at the same time, but only if you are using the system console. This feature makes it seem as if you have several separate system consoles, each simultaneously running either Unix or DOS software. You switch from one session to another using a special hotkey.

■ If all you need is a multiuser DOS system, there are more-efficient and less-expensive solutions than a DOS-under-Unix environment.

Also important is the fact that both programs support DOS-to-Unix and Unix-to-DOS pipes. Pipes—one of the Unix system's key features—lets you route the output of one program to the input of a second, so that the two can operate synergistically. For example, you can count the number of users on a system by piping the output of Unix's who (display list of users) command to the wc (word count) command. By allowing pipes, *VP/ix* and *Merge 386* let you create hybrid programs that bridge DOS and Unix.

A REALITY CHECK While DOS-under-Unix software can run most of the DOS applications software library, it won't run all of it. For example, applications like *Windows/386, DESQview 386,*

PC MAGAZINE DOS Environments that Run Under Unix: Summary of Features

(Products listed in ascending price order)

The two DOS environments reviewed here have many features in common. Each of them will

- support both CONFIG.SYS and AUTOEXEC .BAT, systemwide, per user, or per session;
- access communications ports COM1 and COM2;
- access floppy disk drives A: and B:;
- access one DOS partition per hard disk drive;
- boot software on a DOS floppy disk;
- support multiple sessions on the system console;
- support the IBM high-order character set, the PC keyboard, and graphics applications, on the system console;
- access Unix partitions and permit Unix filename mapping;
- execute Unix commands from the DOS environment, and vice versa;
- provide Unix-to-DOS and DOS-to-Unix pipelines;
- convert Unix text files to DOS format, and vice versa.

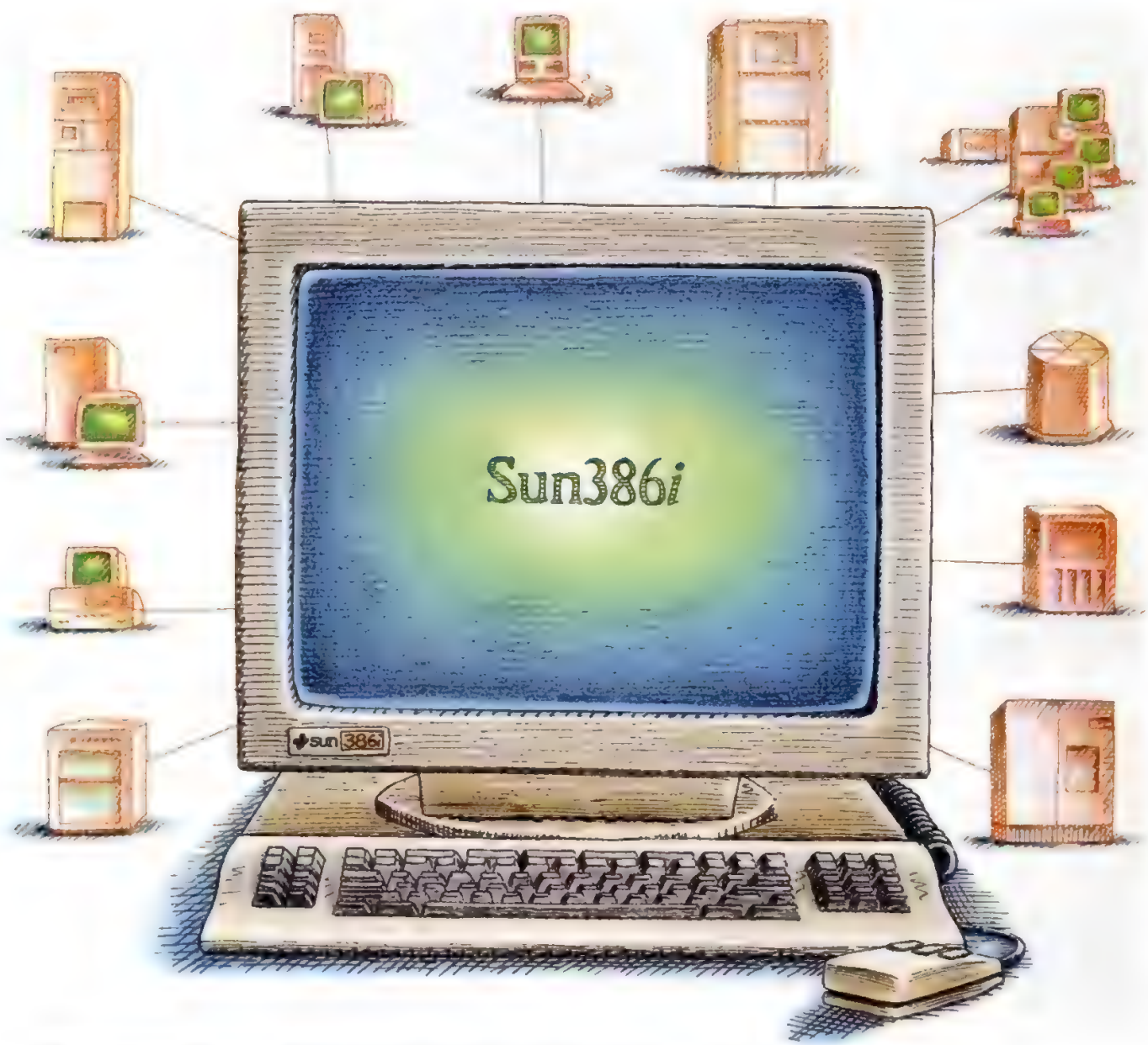
Other features are plotted in the table.

	Merge 386 With Unix: $795 (2 users), $1,595 (unlimited)	VP/ix With 386/ix operating system and TEN/PLUS user interface: $695 (2 users), $1,395 (unlimited)
DOS ENVIRONMENT		
DOS version supplied	3.21	3.3
DOS versions supported	3.3, 3.2, 2.*x*	3.3, 3.2, 2.*x*
Additions to DOS commands	merge, printer, unix2dos, dos2unix, udir, on, quit	rununix, unixpath, dospath, xdir, lef, dosmount, quit
Supports expanded memory	○	●
Floppy disk densities supported	360K, 720K, 1.2MB, 1.44MB, virtual	360K, 720K, 1.2MB, 1.44MB, virtual
Mouse support	●	●
Serial	●	●
Bus	●	●
Microsoft inPort	●	●
PS/2	○	●
Graphics support		
CGA	●	●
EGA	●	●
VGA	○	●
8514	○	○
Hercules	○	●
Handling of hung applications		
Exits DOS session	●	●
Starts new DOS session	○	●
UNIX FEATURES		
Disk space required to install DOS environment	2.5MB	2MB
Recommended memory per DOS session	1MB	1MB
New Unix commands	dos, newdos, dosopt, dosadmin, dosboot, dos2unix, unix2dos, newunix	vpix, shell enhancements
Remote terminal support	DEC VT-100, HDS 200, TeleVideo PCS1, WYSE WY-60 (any ASCII terminal)	DEC VT-52, VT-100; LINC 3, LINC 5; SunRiver terminals; WYSE WY-60
Supports IBM's high-order character set on		
SunRiver graphics terminal	○	●
PC Scancode terminals	●	●
Standard terminals	○	○
Supports PC keyboard on		
SunRiver graphics terminal	○	●
PC Scancode terminals	●	●
Standard terminals	○	○
Supports graphics applications on		
SunRiver graphics terminal	○	●
PC Scancode terminals	○	○
Standard terminals	○	○

● — Yes ○ — No

OS/2 promises you the moon.

But it'll ne
everything u



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■ DOS UNDER UNIX

Paradox 386, or OS/2, which try to go into the protected modes of the 286 or 386, will definitely not work. The Unix system has already usurped that privilege. Other potential problems are:

- Applications that perform extensive low-level access to PC hardware. Most PC software does a good job of emulating hardware, but sometimes problems arise when an application bypasses the operating system to talk directly to the hardware.
- Applications that are timing-sensitive. Timing is not very predictable in a multiuser environment. Similarly, applications that generate a high interrupt rate may not work well.
- Applications that perform low-level access to the DOS file system. DOS-under-Unix software primarily uses the Unix file system, which doesn't have the standard DOS directory structure or DOS's File Allocation Table, among other things. Usually this doesn't cause a problem because most programs use DOS file I/O calls. Exceptions are DOS file system repair or enhancement programs. The Unix system has its own utilities for file system repair.

In addition, you'll need to check with prospective vendors to see whether their systems will support such devices as communications boards, networking boards, tape controllers, and data acquisition boards, for which DOS drivers exist.

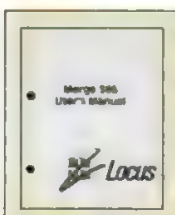
THE BOTTOM LINE If all you need is a multiuser DOS system, there are more-efficient and less-expensive solutions than a DOS-under-Unix system. If you need a multiuser, multitasking DOS system and you also have a compelling need for Unix, or if your primary operating system is Unix and you need access to the large base of sophisticated DOS applications, then you should think seriously about bringing in a DOS-under-Unix program. If you already use a version of Unix on your 386 machine, the choice of which DOS-under-Unix product to buy has probably already been made for you: some Unix vendors support only *VP/ix* or a specific variant, some support only *Merge 386* or a specific variant, and some don't support either. But if you are thinking about a move to Unix, you should carefully consider whether you want to run *VP/ix* or *Merge 386*, then choose your Unix software accordingly.

Merge 386

Merge 386, from Locus Computing Corp., is a highly configurable DOS-under-Unix system. It works solidly, has many options and configuration possibilities, and is a good performer. But *Merge 386*'s chief advantages—its flexibility and configurability—are also weaknesses: you must work hard to make it run the way you want. In addition, *Merge 386* lacks some of the amenities that DOS users have come to expect, such as support for VGA (Video Graphics Array) graphics and EMS (expanded memory specification) memory.

Running under Bell Technologies' Unix, *Merge 386* is delivered with DOS 3.21. A license for one or two users costs $695, and an unlimited license costs $1,195. Furthermore, you can even install your own version of DOS if you prefer: in addition to Version 3.21, the program supports DOS 3.3, 3.2, and 2.*x*. Like *VP/ix*, *Merge 386* works best with about 1MB of memory available for each active session, in addition to the 2.5MB memory required for the host Unix system. Also like *VP/ix*, *Merge 386* lets you run more tasks than will fit in memory, but with some performance degradation. Unlike *VP/ix*, however, *Merge 386* can be configured to create a DOS environment containing less

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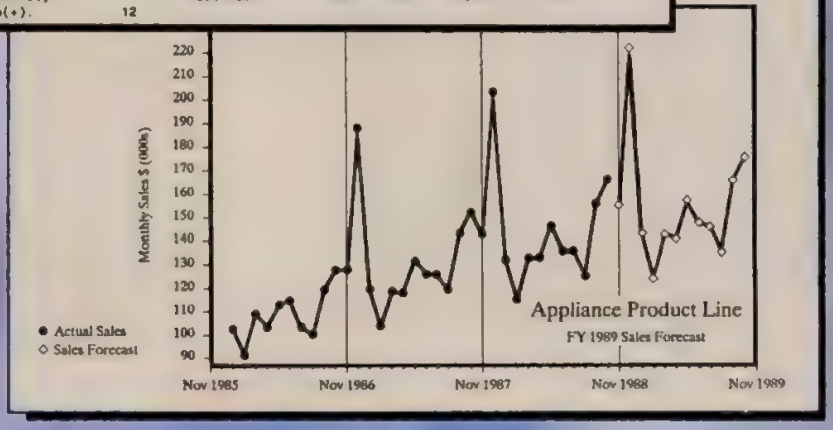


Merge 386
Locus Computing Corp.
9800 La Cienega Blvd.
Inglewood, CA 90301
(213) 670-6500
List Price: Without Unix operating system: license for one or two users, $695; unlimited license, $1,195. With Bell Technologies' Unix: license for one or two users, $795; unlimited license, $1,595. PCILib: $995.
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EXTENDING THE VIRTUAL 8086 ENVIRONMENT

Emulating the standard hardware/BIOS environment of a PC using the 80386 processor's virtual 8086 mode is no small feat, but it's necessary if you want your DOS-under-Unix system to be able to use the slew of peripherals and facilities—scanners, networks, mainframe communications, graphics tablets, joysticks, trackballs, and others—that are part of the PC's everyday environment. None of these are emulated in the standard *VP/ix* or *Merge 386* environments, but they can be accommodated by extending those environments.

The first level of support offered by both products allows a DOS session direct access to a device on the PC bus. In *Merge 386* parlance, this is called DDA (direct DOS attach). In *VP/ix*, it's also called DDA, but it stands for "direct device access." In both cases, DDA lets a single DOS session use a hardware device that isn't in the standard set of supported devices.

When you use DDA, the virtual 8086 environment is set up so that accesses to the device's addresses go directly to the device, just as if the program were running in real mode on a standard DOS system. This happens even as all other accesses to "standard" hardware addresses go to emulated devices rather than directly to the bus. Interrupts by DDA devices activate a generic Unix interrupt handler, which relays each interrupt into the proper virtual 8086 session.

The big advantage of DDA is that it is easy to use. (Both Locus Computing and Interactive Systems report that a sizeable number of their users are working with DDA.) You just specify the I/O ports, memory addresses, interrupt vectors, and DMA (direct memory access) channels that are used by the device in question; then you ask to use that device when you are starting a DOS session. *VP/ix* and *Merge 386* have similar capabilities in this area, except that only *Merge 386* supports DMA.

VP/ix and *Merge 386* also allow you to create drivers for specialized devices such as network interfaces. This process is much more complicated and expensive than DDA, and you need a talented systems programmer to write the code. For the most part, this step is taken by OEMs and system integrators to meet the needs of a large client base. Few end users, if any, write device drivers.

Although it takes a lot of talent and effort to write device drivers, these tools have several advantages. With a device driver, you can field interrupts more rapidly and with less overhead than when you use DDA interrupt handling. Another advantage is that some devices, such as network interfaces, can be shared by multiple DOS sessions if they are accessed through a device driver. (When they are accessed through DDA, only one session at a time can use the device.) And with *VP/ix*, you must use a device driver to interface to a device that uses DMA data transfers. (*Merge 386* can handle many such devices with DDA.) *VP/ix* comes with all you need to create a device driver, whereas Locus recommends that you contact its technical support staff and work closely with them if you choose to create one.

Another approach to extending the environment involves developing programs that bridge the chasm between DOS and Unix. With *Merge 386*'s PCILib facility or *VP/ix*'s Channels facility, you can write a distributed application—for example, a DOS user interface program that uses a Unix database server. PCILib costs $995; Channels is included with the *VP/ix* package.

DDA lets DOS sessions access unusual hardware. Device drivers, while more demanding to create, let you manage more hardware, more efficiently. Both *Merge 386* and *VPix* offer software libraries that let you gain mastery over distributed applications. Both products cover the bases and the turf in between.

—Kaare Christian

than 640K of RAM, which reduces the strain on system memory.

The documentation that comes with *Merge 386* contains all the information you'll need—but don't expect light reading. Although the program's installation procedure is so easy to follow that you probably won't need to consult the manual, you will have to slog through it to configure and tune the program.

The documentation consists of a thick manual that deals with Version 1.0 of the program, plus a skinny booklet on Version 1.1. Don't make the mistake of overlooking this second pamphlet; Version 1.1 includes a lot of important enhancements you'll want to know about. It would be more helpful if Locus provided one unified manual that covered all the bases.

Merge 386 lets you run most DOS commands from the Unix environment and most Unix commands from the DOS environment. True to its name, it merges two worlds, allowing you to install new software that will be accessible from both and to create pipes from one environment to the other. By default, both environments use the Unix file system. If you have a DOS partition on your hard disk, it is accessible only to DOS software.

Merge contains a screen-switch utility that lets you sequence from one active session to another. Although serial-terminal users can run only one session at a time, console users can run multiple DOS and Unix sessions, conveniently switching from one to the other.

A COMFORTABLE SETUP When *Merge 386* starts to run, the program assigns the C: drive to the Unix file system. COMMAND.COM and CONFIG.SYS files exist in the Unix root directory, just as they would in the root directory of a standard DOS C: drive. I liked this arrangement because the C: drive is the place to be when you're running DOS. You can also put your personal AUTOEXEC.BAT and CONFIG.SYS files in your home directory, executing them in addition to or in place of the systemwide files stored in the

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BRINGING DOS COMPATIBILITY TO NON-80x86-BASED SYSTEMS

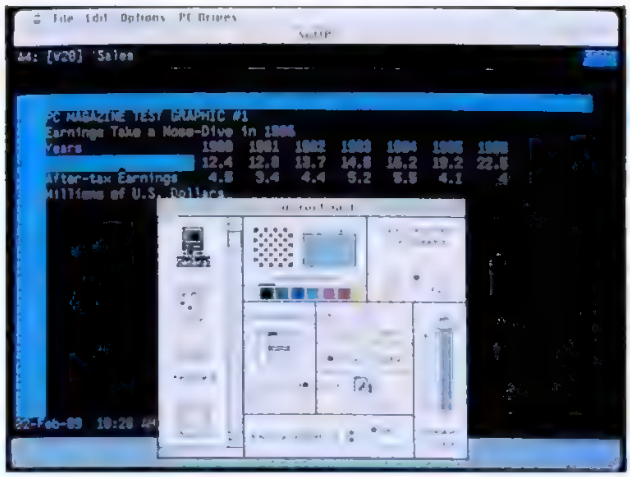
If you need to run a DOS application on a non-80x86-based machine, you can effect DOS compatibility by using one of two programs: Hunter Systems' XDOS or Insignia Solutions' SoftPC.

Like it or not, if you use non-DOS hardware, you might occasionally need to run a DOS program. You may receive a file in a format that's not readable by any program native to your system; you may have to run a program that was developed in-house under DOS and cannot be readily translated; or you may simply need to run a corporate standard like *Lotus 1-2-3*, *DisplayWrite*, or *dBASE III Plus*.

On non-DOS systems that use 80x86 processors, programs like Interactive Systems' *VP/ix* and Locus's *Merge 386* can provide DOS compatibility through the processor. But systems based on different architectures require more complex solutions. The most obvious answer is to put an 80x86 processor on a card and transfer program execution to the card. This is the approach AST Research took with its AST Mac286 card for the Macintosh II. This add-in board gives true 80286 instruction-set compatibility to the Macintosh, but at substantial expense and with a loss of integration.

The less-obvious answer is to effect DOS compatibility through software. And that's just what Insignia Solutions (based in Sunnyvale, Calif.) and Hunter Systems (Mountain View, Calif.) are doing with their respective programs *SoftPC* ($595 for the Macintosh II and SE) and *XDOS* ($325 to $975 for Unix-based machines).

In addition to the Mac II and SE, *SoftPC* supports the Sun 3, the HP 9000 Series 800, the Tektronix 4200 and 4300, and the Intergraph Clipper chip running on the Interpro 32 or 34. Among the systems that *XDOS* supports are the Sun 3, the Apollo, the NCR Tower, the Motorola 8000, the Acer Counterpoint, the Sony NEWS workstation, and the Hewlett-Packard 9000. You can call Insignia Solutions at (408) 522-7600 and Hunter Systems at (415) 965-2400.



SoftPC, *$595 from Insignia Solutions, emulates the Intel 8088 through software, thus enabling a Macintosh II or SE to run any DOS application.*

The approaches taken by *SoftPC* and *XDOS* differ from the start. *SoftPC* allows you to run any off-the-shelf DOS application without modification by emulating the Intel 8088. With *XDOS*, however, you recompile 80x86-based programs, optimizing them for the new environment.

INVISIBLE TRANSLATIONS *SoftPC*'s designers believe that translations should be transparent to the user. Insignia has made a theatrical move: when you launch the Macintosh version of *SoftPC*, it greets you with the simulated sound of a floppy disk drive head moving and a beep—the familiar sounds of an IBM PC-XT booting up. From then on, its simulation of the DOS environment is almost perfect.

SoftPC makes several concessions to hardware differences. You can make the built-in mouse emulate a Microsoft Mouse, and if you have Apple's external 5¼-inch drive or the DaynaFile, you can define it as the A: drive. The next major release, which should be out by the time you read this, will support Apple's new

Photograph: Thom O'Connor

root directory. Drive D: accesses your home directory, and drive E: accesses the DOS partition, if there is one, on your hard disk. Most people will find this a comfortable and comprehensible setup.

A host of options let you fine-tune *Merge 386*'s performance. Version 1.0 featured the dosadmin and dosopt commands, which are designed for tailoring the default operation of *Merge*. These commands let you specify the amount of memory used, the default console screen type, printer operations, the attachment of special devices to your session, and the use of systemwide or user-specific CONFIG.SYS and AUTOEXEC.BAT files. Version 1.1 adds the Merge command, which is designed to manage new 1.1 op-

3½-inch Smartdrive, allowing access to 3½-inch IBM floppy disks on machines equipped with it. Every DOS program we tested would run straight out of the box when used with this program.

While *SoftPC*'s simulation of an 80*x*86-based DOS environment seems ideal, it comes with a severe performance penalty. On a 16-MHz 68030-based Macintosh IIx—the fastest machine that Apple makes—*SoftPC* takes roughly 1.2 times as long as an IBM PC AT or PC-XT. While this is acceptable for occasional use, you'll waste a phenomenal amount of processing power if running DOS applications represents a substantial amount of your computing time.

PERMANENT CONVERSION

Where *SoftPC* simulates the 80*x*86 processor, allowing existing DOS programs to run unaltered, *XDOS* permanently converts them to 680*x*0-based binary code. This approach has two advantages. Performance is much better than could be achieved through software emulation, since there is little overhead introduced by the simulation at runtime. And since you are using a native Unix program, you have full access to the Unix system's memory, disks, peripherals, and multitasking abilities.

XDOS handles basic differences between the DOS and Unix environments in the translation. A runtime module on the Unix system handles environment-specific issues like video calls. In the recompilation, these activities are directed to routines in the runtime module, which differs from one implementation of Unix to another. Since the recompiled core program accesses these routines in the same way no matter what the system, the program is the same for any Unix implementation you run it on. Support for additional environments is achieved by simply replacing the runtime module. Hunter Systems readily admits that performance will be 70 to 90 percent as efficient as the same program rewritten from the bottom up for the new system.

So you're sold; how do you get *XDOS* and how much does it cost? At present, this is the biggest catch. If you want to run popular DOS applications that *XDOS* already supports, such as *Lotus 1-2-3*, *dBASE III Plus*, *WordPerfect*, *Microsoft Word*, *AutoCAD*, and *Ventura Publisher*, then *XDOS* is a solution you can use today. Hunter Systems can supply you with the tools necessary to convert existing copies of your DOS programs into Unix versions. But if you want to convert an unsupported third-party program or one developed in-house, it won't be that easy. Hunter Systems would rather make royalty arrangements with software manufacturers than let its tools loose on the world. It does not provide *Analyzer*, which determines recompilation strategies, to the public. In time, it may offer this program for lease only. Among new applications, this will probably limit its usefulness to major operations.

If you want DOS, with its familiar prompts and utilities, on a non-80*x*86 system, *SoftPC* is a good solution that doesn't require the addition of hardware. *SoftPC* will also deliver what you need if you occasionally want to run a DOS application, or if you want to run a program that was developed in-house, and speed is not particularly important. With *SoftPC*, you should be able to run any DOS application—even RAM-resident utilities and programs that use disk-based copy-protection schemes.

XDOS, on the other hand, will let you apply almost full system power and function to DOS applications by recompiling them as Unix applications on non-80*x*86 systems—but only if they are currently supported by *XDOS*. If you want to run homegrown applications or those that are not on the supported list, then *XDOS* cannot help you, at least not at this time.

Of course, if you are using a system that is not 80*x*86-based and you want to run a variety of DOS utilities and programs often, then something is wrong with your basic setup. You are best off investing in a secondary system that runs DOS, or else switching to alternative programs available in your native environment.—**Philip F. H. Rose**

Philip F. H. Rose is a project leader at PC Labs.

tions; you can set the DOS clock rate to 1 tick per second or the standard 18 ticks per second, and you can force applications that poll the keyboard to sleep, thereby boosting performance for other system tasks.

Although commands like these afford us great control over our software, naturally we want the defaults to work most of the time. After all, a DOS-under-Unix product should boot up DOS and run DOS programs with no hassles. My first frustration with *Merge 386* came when I tried to run the PC Labs benchmark tests and found that some of the timing results were skewed. This occurred because, by default, *Merge*'s DOS clock ticks just once per second, not 18 times as in a normal DOS machine. (Since most DOS software

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■ DOS UNDER UNIX

is not sensitive to the clock tick rate, this isn't a major problem. But it does illustrate Locus's philosophy: Performance comes before convenience.) If you encounter a similar problem, don't look in the manual for the solution; it's described only in the Version 1.1 Release Notes.

A JUDGE'S DECISION Locus Computing claims that *Merge 386* is the DOS-under-Unix performance champ. The claim is based partly on how the vendor wrote the software and partly on the many configuration options that let you tune the environment for *your* software. PC Labs' multitasking benchmark tests do suggest an edge for *Merge 386*, but this is definitely a judge's decision, not a knockout.

■ PC Labs' multitasking benchmark tests suggest an edge for *Merge 386*, but this is definitely a judge's decision, not a knockout.

We tested *Merge 386* running under Bell Technologies' Unix System V, Release 3.0, on a Compaq Deskpro 386/20 with 7MB of memory and a 60MB disk. What did we find? When just one task is active, *Merge 386* is significantly ahead on I/O (DOS File Access tests), but both programs clock in at about the same speed when performing computationally intensive operations (80386 Instruction Mix and Conventional Memory tests). Both programs slow down as background jobs put a load on the system; overall, *Merge 386* remains slightly ahead in both computational and I/O efficiency.

Merge 386 gives you three options for graphics on an EGA console: CGA graphics, EGA graphics, or Fast EGA graphics. Support for VGA graphics is sorely lacking. In its ordinary EGA graphics mode, *Merge 386* is pretty slow and would probably frustrate people who are used to the fast video speeds of 386 machines. But *Merge 386* speeds up significantly in Fast EGA graphics mode, outperforming *VP/ix*. The problem with this mode is that you lose the screen-switching ability on the console, which is the key to working with the system from the console.

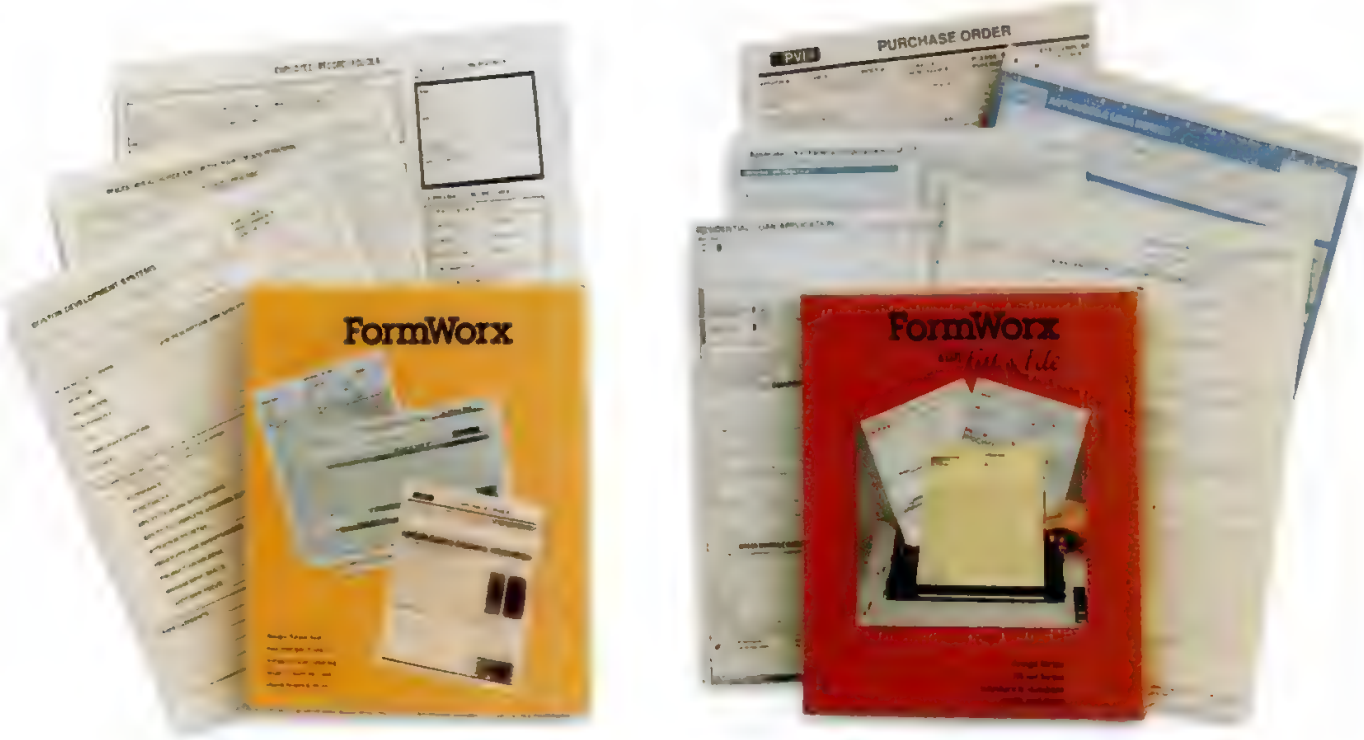
In further testing, a remarkable finding was connected with *Merge*'s video performance when using a serial terminal. The internal mechanism involved looks for changes in a virtual screen buffer that the system maintains. PC Labs' video benchmark tests are analogous to political speeches: they repeatedly write the same thing to the screen. Because *Merge* is looking for changes, it sends little information down the slow serial line to the terminal, thereby producing winning but terribly misleading numbers. Normally, *Merge*'s video display speeds would be comparable to those of *VP/ix*, because real applications don't just idly redraw the screen.

COMPATIBILITY TESTS The standard harbingers of doom for nonstandard PCs—*Lotus 1-2-3*, *Microsoft Flight Simulator*, *Microsoft Word*, and *Microsoft Windows*—worked fine in the *Merge 386* environment. *1-2-3* and *Word* worked both on the console and on serial terminals. The trouble with both *Windows* and *Word* on the console was speed. Both seemed pretty sluggish when I used the standard EGA mode, but I was very reluctant to use the Fast EGA mode because I value the program's screen-switching function.

I encountered an impasse in trying to run *DESQview*, Version 2.0. At each attempt the opening screen appeared, followed by an ugly "Divide by zero" message, which hung the DOS session. I tried several of the *Merge* options but couldn't get around this problem. *Merge 386* leaves little reason to run pseudo-multitaskers like *DESQview*, but it should still be able to handle them.

Overall, *Merge 386* is a reliable performer with a wide variety of hooks and controls that are great if you're looking for a program with a high degree of flexibility and configurability. But you must work hard to gain these benefits, sometimes having to think about your operating environment when you'd rather be thinking about the task at hand.

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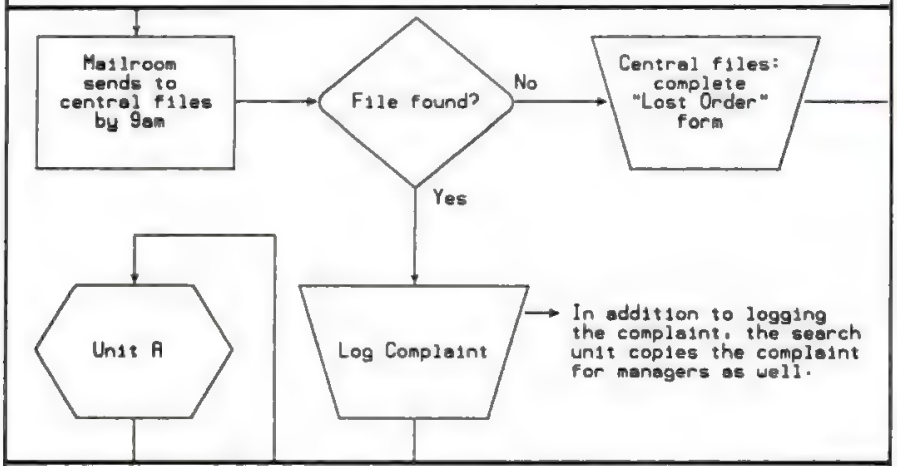
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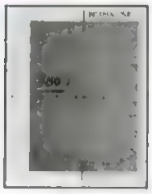
VP/ix

If you're looking for a DOS-under-Unix environment that will tide you over until the next millennium, check out *VP/ix*, a joint venture of Interactive Systems Corp. and Phoenix Technologies. This program runs most DOS applications, supports VGA graphics as well as EMS, and handles the exciting SunRiver high-speed, high-resolution graphics terminal, so that several users can simultaneously use DOS (or Unix) graphics software.

VP/ix runs under Interactive Systems' own Unix variant, 386/ix, and is delivered with DOS 3.3. If you prefer, you can use your own version of DOS, since the program also supports DOS 3.2 and 2.*x*. The program costs $695 for a two-user license, and $1,395 for an unlimited license. The *VP/ix* package contains a useful and thorough manual, replete with easy-to-use scripts for installation and most aspects of system administration.

You should set aside about 1MB for each active *VP/ix* session in addition to the memory requirement for the host Unix system, which is usually 2MB. Because Unix can run more tasks than will fit in the memory, you can run about five simultaneous *VP/ix* sessions on a machine with only 4MB memory. But you will nonethe-

PC MAGAZINE FACT FILE



VP/ix
Interactive Systems Corp.
2401 Colorado Ave.
Santa Monica, CA 90404
(213) 453-8649
List Price: License for one or two users, $695; unlimited license, $1,395 (includes *VP/ix*, 386/ix operating system, TEN/PLUS user interface, and Channels Facility).
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Benchmark Tests: DOS-under-Unix Environments

PC Labs tested *VP/ix* and *Merge 386* using our standard suite of system benchmark tests as well as our multitasking load tests. We also ran the File Access tests against file space in the Unix partition of the disk. Both products supported this feature and performed significantly better than when they used the DOS partition.

In the 80386 Instruction Mix and File Access tests, *Merge 386* performed faster than *VP/ix* on the same hardware, but not by much. *Merge 386*'s lead in our single-tasking processor tests was consistent but not so large that it should sway a purchasing decision. *Merge 386*'s performance on the File Access tests is another story. In the small-record File Access test, *Merge 386* using the Unix file partition is almost twice as efficient as *VP/ix*.

Both *VP/ix* and *Merge 386* held up well under the pressure of our multitasking load tests. *VP/ix* fell behind somewhat when performing the multitasking DOS File Access tests, but it outperformed *Merge 386* on some of the Conventional Memory and 80386 Instruction Mix tests. This contrasts with *Merge 386*'s faster times in our tests without multitasking, and highlights the packages' different strengths and weaknesses. Since neither package turned in glaringly bad results on any test, you should put the most emphasis on those aspects that reflect your needs to determine which package will be the better performer in your environment.

PC Labs' multitasking operating system benchmark tests determine the amount of performance degradation that operating environments suffer as they process more tasks. The tests use versions of the 80386 Instruction Mix and DOS File Access tests, which have been modified to run continuously. The modified Instruction Mix test accesses the processor and writes to the screen constantly, thus emulating a busy, processor-intensive application program. Similarly, the modified DOS File Access test emulates an I/O-intensive program.

Testing was conducted on a Compaq Deskpro 386/20 with a 60MB hard disk and 7MB RAM. With zero to three sessions of either modified benchmark test running in the background, we ran our standard 80386 Instruction Mix, Conventional Memory, and DOS File Access benchmark tests.

The **80386 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80386 instruction code. These instructions are a subset of the total processor instruction set. The 80386 Instruction Mix implements a number of 32-bit operations. In the 80386 processor these become single instructions, whereas in the 8086 and 80286 versions of the benchmark test they remain multiple instructions.

The **Conventional Memory** benchmark test allocates 256K of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The **DOS File Access** benchmark test measures the throughput rate of the disk being tested. In this case, throughput times are measured in terms of how long the disk takes to perform common DOS file-management functions. Five tasks—file creation, sequential file write, sequential file read, random file write, and random file read—are timed and the results summed.

The test is carried out for two different types of files—small-record files and large-record files—that are used by common PC applications. Files created using small records are typically used by database management programs, and large records are typically used for word processing and spreadsheet files. Loading a DOS program is also simulated by the large-record test.

Performance Times (Times given in seconds)	Processor and Memory Benchmark Tests: 80386 Instruction Mix	Processor and Memory Benchmark Tests: Conventional Memory	Disk Benchmark Tests: File Access (small record) (Unix partition)	Disk Benchmark Tests: File Access (large record) (Unix partition)	Disk Benchmark Tests: File Access (small record) (DOS partition)	Disk Benchmark Tests: File Access (large record) (DOS partition)
VP/ix	3.12	0.46	59.92	48.78	70.07	44.09
Merge 386	3.02	0.43	33.61	19.77	54.38	38.56
OS/2 Compatibility Box	2.94	0.41	N/A	N/A	56.35	10.69
DOS 3.2	2.91	0.40	N/A	N/A	57.29	10.46

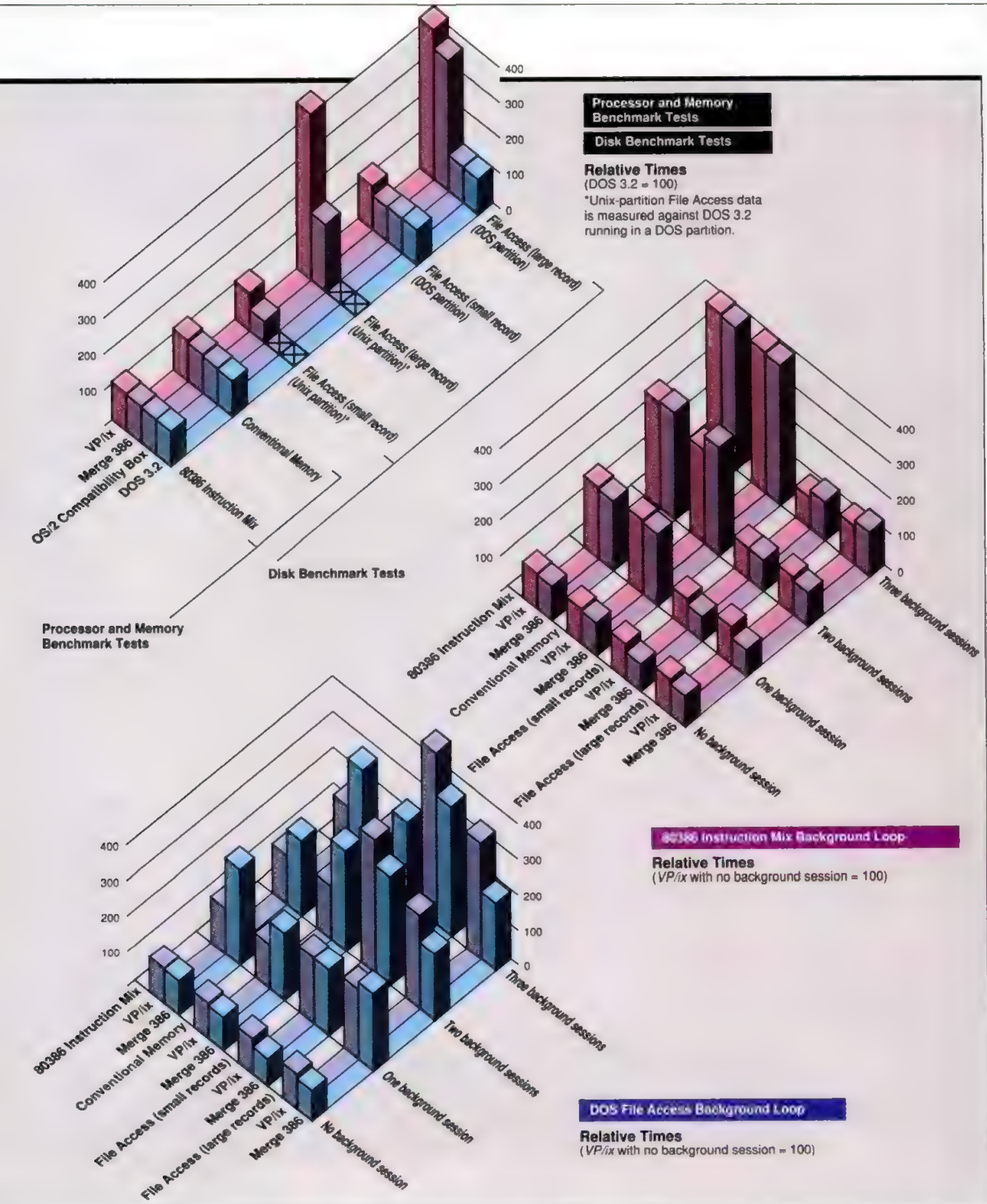
N/A—Not applicable: OS/2 and DOS do not have Unix partitions.

80386 Instruction Mix Background Loop

Performance Times (Times given in seconds)	No background session	One 80386 Instruction Mix background session	Two 80386 Instruction Mix background sessions	Three 80386 Instruction Mix background sessions
80386 Instruction Mix				
VP/ix	3.12	6.24	9.28	12.59
Merge 386	3.02	6.04	9.43	12.45
Conventional Memory				
VP/ix	0.46	0.95	1.21	1.83
Merge 386	0.43	0.92	1.40	1.81
DOS File Access (small record)				
VP/ix	70.17	60.15	60.94	61.88
Merge 386	54.38	48.44	61.62	76.45
DOS File Access (large record)				
VP/ix	44.15	47.39	47.33	47.27
Merge 386	38.56	33.27	42.18	54.39

DOS File Access Background Loop

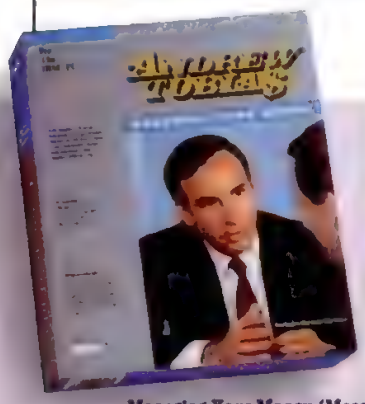
Performance Times (Times given in seconds)	No background session	One DOS File Access background session	Two DOS File Access background sessions	Three DOS File Access background sessions
80386 Instruction Mix				
VP/ix	3.12	4.07	4.26	4.16
Merge 386	3.02	8.44	6.59	8.37
Conventional Memory				
VP/ix	0.46	0.59	0.70	0.71
Merge 386	0.43	0.89	1.30	1.02
DOS File Access (small record)				
VP/ix	70.17	132.67	266.07	337.76
Merge 386	54.38	130.17	216.16	265.74
DOS File Access (large record)				
VP/ix	44.15	86.71	117.77	144.95
Merge 386	38.56	95.90	84.40	85.36


Processor and Memory Benchmark Tests
Disk Benchmark Tests
Relative Times
(DOS 3.2 = 100)
*Unix-partition File Access data is measured against DOS 3.2 running in a DOS partition.
400
300
200
100
0
VP/ix
Merge 386
OS/2 Compatibility Box
DOS 3.2
80386 Instruction Mix
Conventional Memory
File Access (small record)*
File Access (large record)*
File Access (small record)
File Access (large record)
(DOS partition)
(Unix partition)*
Disk Benchmark Tests
Processor and Memory Benchmark Tests
80386 Instruction Mix
Conventional Memory
File Access (small records)
File Access (large records)
No background session
One background session
Two background sessions
Three background sessions
80386 Instruction Mix Background Loop
Relative Times
(VP/ix with no background session = 100)
DOS File Access Background Loop
Relative Times
(VP/ix with no background session = 100)

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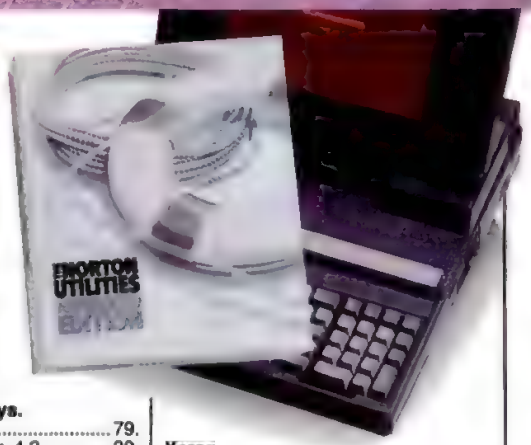
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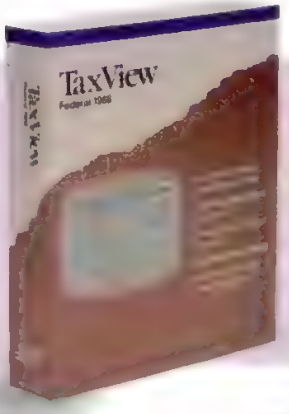


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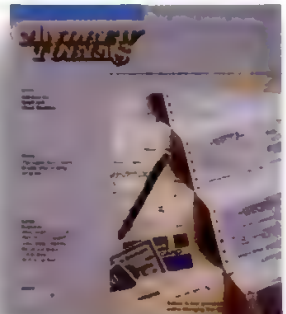
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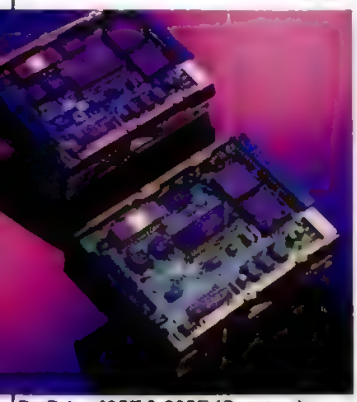
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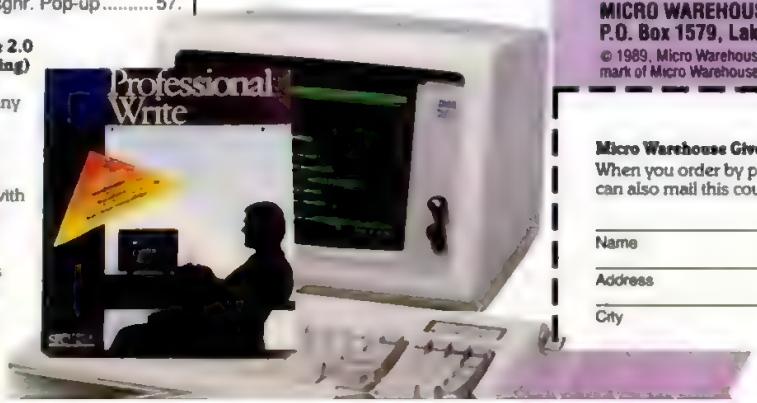
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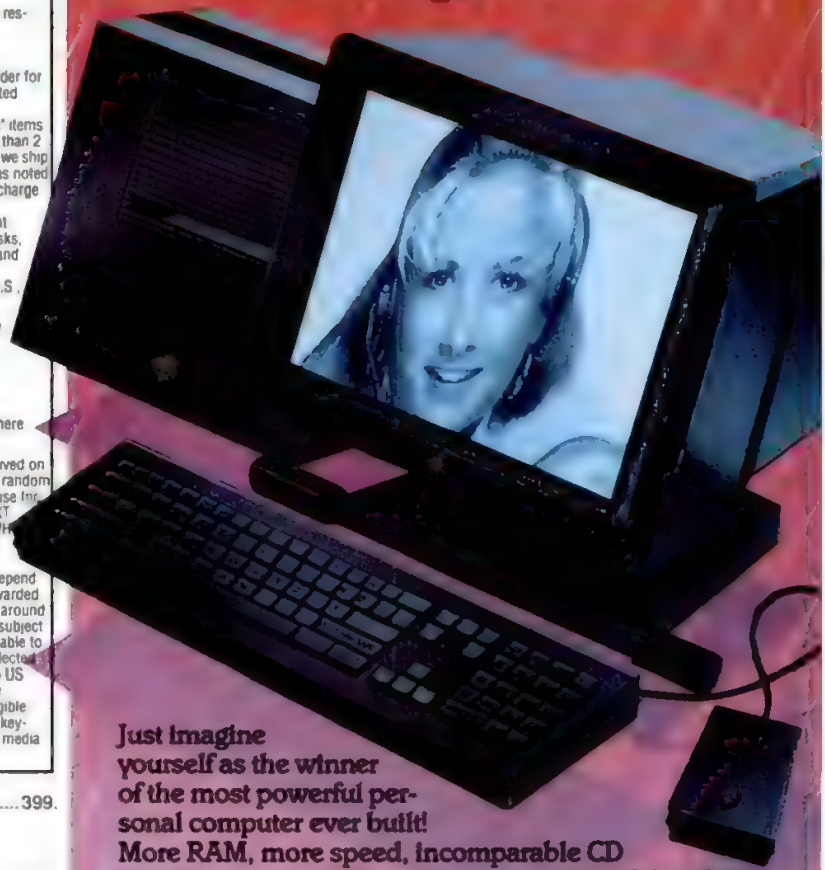
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DOS ON A TERMINAL

If you're interested in running DOS applications on a Unix system, you can choose from three classes of terminals. Here is a brief description of what's available.

In a multiuser Unix system, one lucky user can use the system console (which is compatible with a graphics adapter) and keyboard, while the rest must use terminals—even if they're running DOS applications that can take advantage of graphics facilities. Since most DOS applications will shift down to running on the IBM Monochrome Display Adapter (MDA), in a character-only mode, you'll still be able to run most of them on an ordinary serial terminal that doesn't use a graphics adapter—at the cost of those stunning displays all PC users have come to expect.

If you're going to run DOS applications on a Unix system, you'll have to choose from among three classes of terminals. You should be aware, however, that many terminals can't display the IBM MDA extended character set, which most DOS applications use. Instead, the terminal may require characters from its own character set to be substituted. In addition, because the keyboards don't exactly resemble that of the PC AT, not only will you have to adjust to a new keyboard layout, you'll also have to make sure that your DOS-under-Unix system is flexible enough to provide for keyboard input mapping. And you must be sure that you'll have every possible required keystroke combination available for your DOS application as if you were using a PC keyboard—even if your terminal offers fewer keys.

A WORD FOR THE WYSE Some terminals are designed to mimic the action of the PC keyboard and screen while behaving like standard terminals. An example is the Wyse Technology WY-60, which we tested with a variety of DOS applications. The WY-60's 25-line screen does a very serviceable job of emulating the IBM MDA, so you should have no problem running most spreadsheets, word processors, and databases; most of them run on the MDA.

You won't want to brag about this terminal's display speed, but you should find it adequate for most applications. The 9,600-bit-per-second connection to the host can update the screen in about 2 seconds, but most changes occur faster because only part of the screen is changed.

The WY-60 keyboard looks just like a standard PC keyboard: all the keys are where you would expect them to be, and oddball keystroke combinations such as Ctrl-Alt-SysReq work the way they should. The WY-60 has a list price of $599.

DEC'S SERIAL APPROACH If you have to use DOS software on an ordinary serial terminal like Digital Equipment Corp.'s DEC VT-330, which we also tested, you will need to retrain your reflexes. From afar, the keyboard supplied with the VT-330—and with the inexpensive VT-320—looks like an AT keyboard, but up close you'll notice that the legends are different on many keys,

less see some speed degradation, since Unix uses disk storage to augment main memory when the tasks exceed the memory capacity.

Within the *VP/ix* environment, most things work as they would in a standalone DOS system. For example, when you issue the vpix command, the system chugs away briefly, then the screen clears, and you see DOS boot. What appears looks a lot like a warm boot on a running DOS system, and the process takes about as long. At the conclusion, you get a Z:> prompt. At this point you could almost fool your colleagues into thinking that you were running DOS by itself rather than as a job on a Unix system. But most people's first comment would probably be, "Hey, where'd you get a Z: drive?"

VP/ix solves the problem of group access to nonshareable peripherals, such as the floppy disk and the serial ports, by having configuration files. If a user has a personal VPIX.CNF file, then the settings specified there apply; otherwise the settings in a global VPIX.CNF apply. In a multiuser environment, you would usually use VPIX.CNF to restrict access to nonshareable devices in the default VPIX.CNF—and then enable them for certain privileged users in individual files. *VP/ix* will warn you if a second user starts a session that is configured to access a nonshareable device.

It is disconcerting when you start *VP/ix* and first see a warning, for example, that the floppy disk drive cannot be accessed. But I quickly realized that such a warning is better than simply getting the message "General failure accessing drive A" when you try to access the device from within DOS. It is also possible to release a drive in one session so that it can be picked up by another. This area of *VP/ix* is more rigid than the corresponding features in the *Merge 386* program.

Z: EQUALS C: *VP/ix*'s way of handling the C: drive may surprise you—especially if, like most DOS users, you expect C: to refer to your main hard disk. *VP/ix* has a C: drive, but many users will never need it, because Z: is the DOS drive ID that corresponds to the Unix file system, where most files are stored. In fact, C: is not a real hard disk but a virtual disk—a file in the Unix file system that has been structured to mimic a DOS disk drive. In this virtual drive are the "hidden" files that DOS uses to boot, and the COMMAND.COM file, plus CONFIG.SYS and AUTOEXEC.BAT.

VP/ix's virtual drive doesn't have a

which means that they aren't where you'd expect them to be.

Using the VT-330 to run DOS software is difficult because many common PC keys require multikey sequences on this keyboard. Most of the key combinations start with the Esc key, so you must strike Esc twice to escape. (Try that keystroke combination in *Microsoft Word*, where the Esc key is already overloaded with several functions!)

You'll find this terminal a reliable performer once you are used to it. But in the interim, if you're used to a PC keyboard, you're certainly not going to like the readjustment.

Then, too, the VT-330, like many older terminals, can display only 24 lines of text. Standard PC displays show 25 lines of text, all of which are used by DOS applications. You can define a key that will expose the hidden line, but we'd prefer to see the whole screen all the time. The DEC VT-330 costs $2,038; the VT-320 lists for $545.

THE ULTIMATE—SUNRIVER If you don't want to compromise and you have the money to spend, you can have it all with SunRiver Corp.'s EGA, EGA Plus, and VGA Plus terminals. Listing for $1,999, $2,299, and $2,499, respectively, these terminals give you a graphics screen, a standard PC keyboard, and a blazing fiber-optic link between your system and the display/keyboard unit.

If it were not for the absence of a floppy disk drive in the system unit, you might be fooled into thinking you were using a standalone PC after you saw this unit's screens and performance. In fact, we found that as demanding a graphics software program as *Microsoft Windows* ran about as well on the SunRiver terminal as it did on the system console.

Of course, you get what you pay for: the top-of-the-line SunRiver VGA Plus costs more than some complete AT-compatible systems. But going this route is the egalitarian way for a group of people to share a system.—**Kaare Christian**

PC MAGAZINE EDITOR'S CHOICE

• Ease of use vs. flexibility

There are two situations that require a DOS-under-Unix program: if you're a DOS user and want to bring multiuser and multitasking functionality to that operating system but you also need to use Unix, or if your primary operating system is Unix and you want access to the large base of sophisticated DOS applications.

As we've noted in the introduction to this article, users who already run a version of the Unix operating system may only be able to consider one of the two products we've reviewed or a variant from a secondary vendor. On the other hand, DOS users who are not committed to a particular version of Unix will find that both Merge 386 *and* VP/ix *are good choices, but for different reasons.*

Although VP/ix *and* Merge 386 *take similar approaches to creating a DOS-under-Unix environment, they diverge in ease of use and configurability. If you're looking for a DOS-under-Unix program that will get a functional DOS environment up and running with the least amount of effort on your part, look no further than* VP/ix. *But for environments where flexibility and efficiency are of paramount importance, particularly those burdened by heavy multiuser loads,* Merge 386 *gets the nod as the stronger product.*

fixed size. It is big enough to store a few utilities, but it's not the place to install a major application program.

In addition to a default C: drive, each user or group of users can have a personal C: drive. The default C: drive is not writeable by ordinary users, so those who want to manage their own CONFIG.SYS or AUTOEXEC.BAT will need their own C: drives.

One of the *VP/ix* features that you can access through CONFIG.SYS is EMS memory. The manual warns that you should be stingy in allocating such memory, because using EMS makes each DOS session consume more precious space in the main memory. One *VP/ix* session with a full 2MB EMS allotment takes up about as much memory as three *VP/ix* sessions that don't use EMS.

VP/ix's most obvious weakness is its very slow EMS implementation. Yes, you can run software that needs EMS, but don't plan to break any speed records: the EMS emulation of *VP/ix* runs about as fast as EMS on a 4.77-MHz PC, circa 1983.

Most intriguing is *VP/ix*'s support for the SunRiver graphics terminal (except when you are using the Sun 386i). The SunRiver terminal connects to an adapter board in the host computer that supports four EGA or VGA terminal connections. Each of these terminals is, like any ordinary dumb terminal, just a screen and a keyboard that you use to interact with a host computer. But the SunRiver has a number of distinctions: its use of fiber-optic technology to reduce communication time to almost nothing; its emulation of an EGA or VGA adapter, so that you can use graphics programs; its use of a PC keyboard, so that every key is where you expect it to be; and its inclusion of serial and parallel ports, so that you can enhance your DOS graphics environment with local printers, mice, and modems.

SPEED AND COMPATIBILITY The performance of *VP/ix* is clearly adequate, although *Merge 386* is somewhat faster in a number of areas. We tested *VP/ix* run-

ning under 386/ix—Interactive Systems' version of Unix System V, Release 3.0, for 386-based PCs—on a Compaq Deskpro 386/20 with 7MB of memory and a 60MB disk. When you run just one session, *VP/ix* generally performs close to the speed of native DOS. *VP/ix* turned in good performance on file I/O operations and excellent performance on computational operations and graphical displays.

VP/ix turned in favorable results on our compatibility tests; in fact, we were able to run all of the DOS programs we tried. *Lotus 1-2-3* and *Microsoft Flight Simulator* worked without a hitch. So did the serial version of the Microsoft Mouse. *Microsoft Word* worked fine on the console, but when we tried to run it on a serial terminal, the system seemed to think a graphics display was available and accordingly scrambled the console screen. Yes, a program running on a serial terminal was able to demolish the console screen display, in the process defeating the 386's memory protection features. You can run *Word* on a serial terminal, but you must explicitly use the /C option to tell *Word* to use character mode.

We encountered one minor difficulty that stems from *VP/ix*'s use of a Z: drive. Some programs, like *Microsoft Windows*, have no problem working with drive Z:, but others, like *DESQview*, have a C:-centric view of the world. We were able to use *DESQview*, but its installation program completely gave up after asking a handful of questions about our environment. When we exited *DESQview* after using it for a long time, the DOS session froze. We weren't able to repeat the problem, so we could not determine whether the difficulty was with *DESQview*, *VP/ix*, or the hardware.

Microsoft Windows worked beautifully, both on the console and on the SunRiver terminal. On the console, using the screen switch to go to or from a graphics session was a sluggish procedure, but the facility worked flawlessly. All of the systems that support *VP/ix* (except the Sun 386i) also support screen switching on the console, so that you can switch from one console session to another.

There's a lot to like about *VP/ix*. It ran every DOS program we tried, and it also did well on the PC Labs benchmark tests, both when the machine was supporting just one user and when it was running several heavy background jobs to simulate multiple users. Its support of VGA graphics, EMS, and the SunRiver graphics terminal makes it a good choice for the decade to come. PC

Kaare Christian is a research associate at The Rockefeller University, where he uses both Unix and DOS to build scientific instruments. He is also the author of five books on the Unix operating system.

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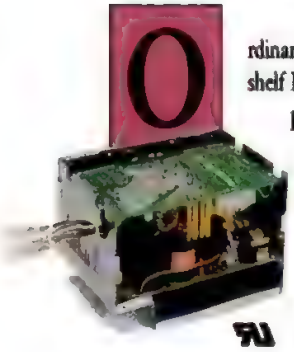
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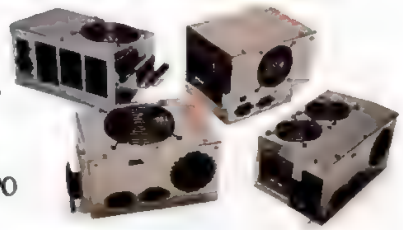
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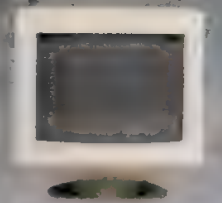
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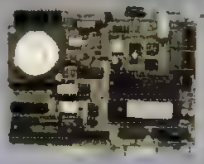
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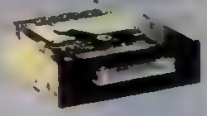
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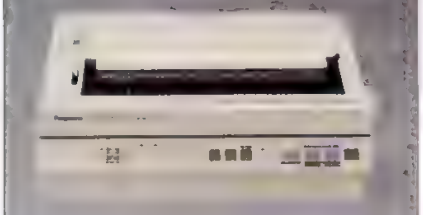
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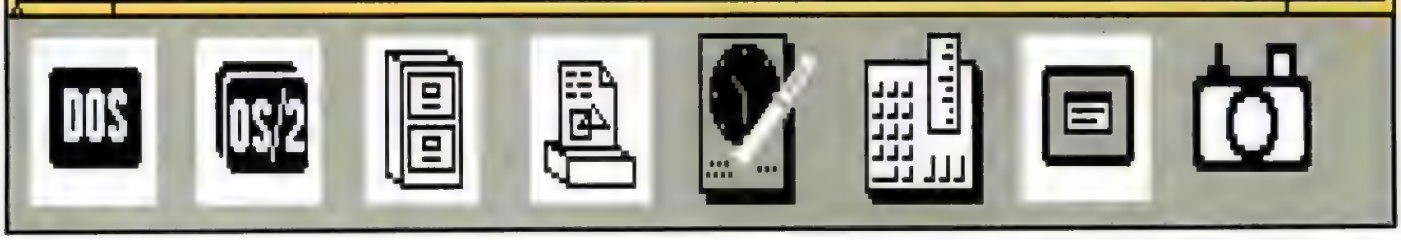
OS/2

With the OS/2 Presentation Manager, IBM and Microsoft have created a graphical user interface that will help bring the PC into the modern age. Are you ready to be carried along with it?

The Truth About Presentation Manager

OS/2 windowed command

This is a story that is not about what it appears to be about. It may seem like a story about an enhancement to an operating-system software product, but it's really not. There is no reason to tell you about a product that you probably won't purchase this year or even next year. By the time you purchase this product—and I have no doubt you eventually will—you'll have a later version than the one I describe



here. Some things I say in this article may no longer be true. Other things will be very obvious to you.

This story is really about the future of PC application software, the applications that you'll be using for much of the next decade. These applications will probably be written for, and will run under, the OS/2 Presentation Manager.

Like all operating systems, OS/2 is meaningless in itself. The support of application programs is its primary function. OS/2 is a relatively new operating system, and the Presentation Manager (included for the first time in OS/2 1.1) is newer still. Obviously, most applications for the Presentation Manager have not yet been written or even conceived.

When these applications become available, I think you'll discover that they are better than what you're using now. They will be easy to learn but at the same time very powerful; visually attractive but also visually interactive; fun to use yet designed for serious work.

Making possible this new generation of PC application software is what the OS/2 Presentation Manager is all about.

A GUI FOR OS/2 The Presentation Manager is a graphical user interface (or GUI) for OS/2. Many concepts of the GUI were originally developed at Xerox's Palo Alto Research Center (PARC) and first successfully brought to small computers with the Apple Macintosh. The GUI has come to be regarded as the state of the art in user interfaces and will probably be common on computers (both small and large) produced over much of the next decade.

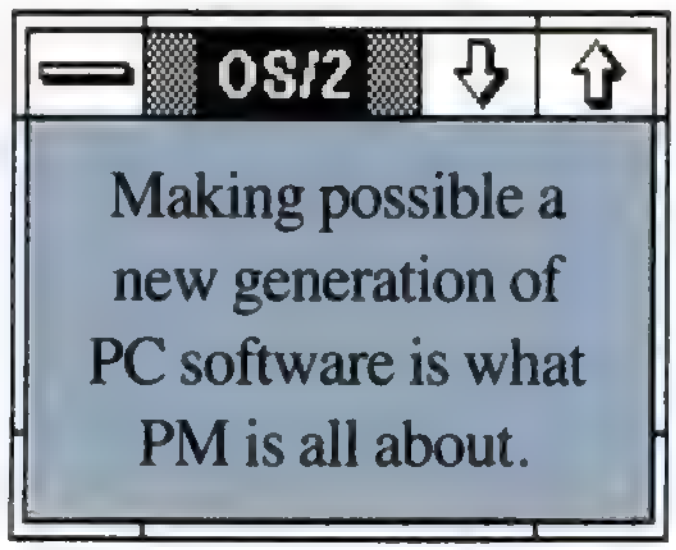
Typically a GUI displays multiple programs in separate windows on the screen. Users can move these windows around, resize them, and easily switch among the programs. The programs have a consistent user interface that makes use of pull-down menus, dialog boxes, and graphical objects such as scroll bars and buttons.

Programs running under a GUI use graphics for all screen output. This makes possible the display of text in different fonts and sizes, as well as the easy integration and manipulation of text and graphics. The use of graphics results in a richer and denser information content than is possible in character mode.

Graphical user interfaces commonly support a secondary user-input device, most often a mouse. The mouse provides an easy way for the user to switch among programs, manipulate windows, and indicate program options.

Users generally find a graphical user interface easy to learn. The GUI establishes a consistency in the user interface that allows knowledge of one application to carry over into the next. Ease of operation becomes increasingly more important as the use of PCs extends to less-sophisticated and more-casual users. Of course, power users also benefit. If the basic functions of a program are trivial to learn, more time can be spent on the more-difficult features (such as macro languages).

The Presentation Manager makes its



debut in OS/2 1.1. Its absence from OS/2 1.0 (released in December 1987 and discussed in "OS/2: A New Beginning for PC Applications," *PC Magazine,* April 12, 1988) may indicate that the Presentation Manager has been "tacked on" to the base operating system. But it's more accurate to see the Presentation Manager as an integral part of OS/2. In this sense, OS/2 1.1 is the first real version of OS/2, while OS/2 1.0 was an unfinished interim product. The Presentation Manager is the primary application environment of OS/2. The future applications that come to characterize the operating system will be written for the Presentation Manager environment.

OS/2 is being developed by IBM and Microsoft working under a joint development agreement. Both companies always intended for the new operating system to support some type of multitasking windowing environment, but at first they did not see eye to eye on the form this interface would take. The Presentation Manager is a result of negotiation, collaboration, and a merging of software technologies.

STRANGE BEDFELLOWS Like politics, the computer industry sometimes makes strange bedfellows. It's hard to imagine two companies more different than IBM and Microsoft, and harder still to believe that any codevelopment between these two industry giants could work at all, let alone yield a worthwhile product. But in a classic example of synergy, the Presentation Manager turned out to be superior to anything either company could have created by itself.

IBM (bigger than Microsoft) got to name the product. "Presentation Manager" is a pretty klunky name all right, but that's IBM. The Presentation Manager includes a sophisticated vector-graphics programming interface, one of the most powerful graphics systems ever brought to a personal computer. And that's IBM, too.

Much of the windowing and user interface technology in Presentation Manager comes from *Microsoft Windows,* a DOS operating environment that Microsoft introduced in 1985. The graphics system in Presentation Manager includes some raster graphics and bitmap support (in addition to the IBM vector graphics technology) that also comes from *Microsoft Windows*.

In software technology, the Presentation Manager combines the best that IBM and Microsoft have to offer. The involvement of both companies in the product is also beneficial for more-practical reasons. Although Microsoft has succeeded in making *Windows* a GUI standard for DOS, this has been a long and laborious process. The endorsement of IBM helps ensure that OS/2 and the Presentation Manager will become industry standards more quickly.

But IBM could not have done it alone. In recent years IBM, working by itself, has had great difficulty establishing standards in either software (witness *TOPView,* IBM's nongraphical windowing environment) or hardware (the Micro Channel architecture of the PS/2). Fear that IBM wants to move to proprietary hardware and operating systems inhibits industry acceptance of anything from IBM that is not built with the concept of open architecture.

The involvement of Microsoft helps to establish OS/2 as an industry standard rather than an IBM proprietary product. Microsoft will be licensing OS/2 and the Presentation Manager to other hardware manufacturers that will adapt it to their own hardware.

IBM's version of OS/2 1.1 was released on the last day of October 1988. Other hardware manufacturers are expected to follow with their versions of OS/2 1.1 during 1989.

APPLICATIONS ON THE HORIZON Of course, it makes little sense for most users to consider moving from DOS to OS/2 until a sufficient number of Presentation Manager applications become available. Some applications are expected this year, but OS/2 probably won't become viable for most users until 1990 or 1991.

Some of the early Presentation Manager programs will be applications now available for *Windows*. These include Aldus's *PageMaker* and *Microsoft Excel* (two programs originally developed for the Apple Macintosh) and several CAD products from Micrografx, including *Designer*. The Presentation Manager versions of these programs will probably show better performance than the *Windows* versions owing to increased memory space, better memory management, and more-efficient multitasking under OS/2.

Microrim and Oracle have both demonstrated early versions of Presentation Manager database products, and Ashton-Tate plans a Presentation Manager version of *dBASE*. In the spreadsheet arena, Lotus Development Corp. plans to introduce *1-2-3/G*, a Presentation Manager version of the best-selling spreadsheet program. It will have some competition from *Microsoft Excel*, as well as Presentation Manager versions of Borland's *Quattro* and Computer Associates's *SuperCalc*.

Word processing, too, reaps benefits from a graphical user interface by gaining a true WYSIWYG display. Although Microsoft and WordPerfect have not officially announced plans for the Presentation Manager, it's quite likely that both companies are working on something. Presentation Manager versions of *MultiMate*, *DisplayWrite*, and *WordStar* are also expected.

The first company to release a Presentation Manager application is Borland International, with *SideKick* for Presentation Manager. Although the program was not available at press time, demonstrations of this new *SideKick* have been very impressive. It is quite different from the old program and introduces some powerful features. For example, the calculator "paper tape" is actually a one-column spreadsheet that can be edited (with changes rippling through the calculation), saved, and retrieved. The phone directory creates a *Paradox* database.

The role of Borland in developing the first commercially available Presentation Manager application is significant: historically, Borland has been a strong critic of *Microsoft Windows*. But like many other companies, Borland apparently sees the Presentation Manager as the environment that will support future PC software.



HARDWARE REQUIREMENTS The hardware necessary to run the OS/2 Presentation Manager has been the subject of much confusion and misinformation. I will try not to add to this confusion, but I think it would be helpful to make a distinction between "minimum" and "practical" requirements. The minimum requirements are what you need to run OS/2 1.1 with no regard to performance, whereas the practical requirements are what you need to achieve adequate performance, operational ease, and reasonable video display fidelity. The minimum requirements to run OS/2 1.1 are an 80286- or 80386-based personal computer with 1MB of memory, a graphics video board and display, and a 10MB hard disk.

IBM's version of OS/2 1.1 supports all its 80286- and 80386-based PCs (the PC AT, the XT Model 286, and PS/2 Models 50 and above). Other vendors' versions of OS/2 1.1 will support their 80286- and 80386-based machines. Obviously, OS/2 will run better on a high-speed 80386 machine than on a low-speed 80286. But so will most other software.

The 1MB minimum memory requirement is probably the lowest OS/2 memory requirement you've ever seen, but it's no misprint. OS/2 will boot and run in 1MB and will even allow a 256K DOS compatibility mode. I've done it, and it works.

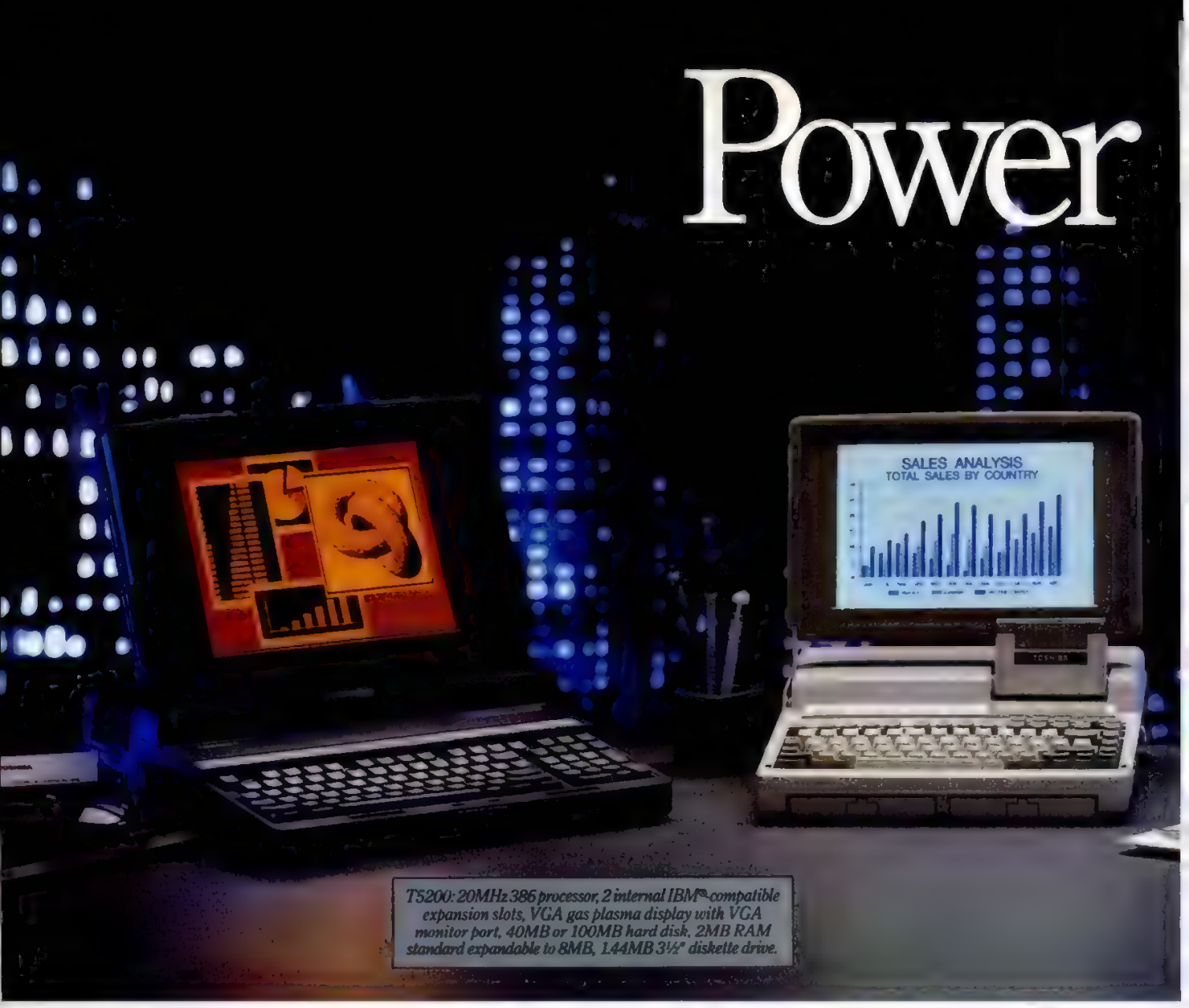
Running OS/2 1.1 under 1MB of memory is equivalent to living in an apartment with 3 by 6 feet of floor space and a large closet. You may not be comfortable, but you could keep most of your possessions in the closet and take out only what you need at any one time. In this analogy, the large closet is your hard disk. OS/2 implements virtual memory, which means that if it needs more memory than is physically available, it will use hard disk space to temporarily store data in memory. When this data is needed again, OS/2 will save something else in memory on the hard disk and swap in what it needs. Only when the hard disk fills up will OS/2 applications actually run out of memory.

While OS/2 1.1 may run under 1MB, performance is intolerable. IBM recommends a more practical requirement for the operating system: 2MB with another 512K if a DOS compatibility mode is used. But 4MB offers a more comfortable environment for the operating system and a couple of applications running concurrently.

Beyond this, estimations of practical memory requirements get a little tricky. It depends on the size of the applications you run, how many you have loaded at the same time, and what performance degradation you are willing to tolerate.

The performance problems will occur mostly in switching among programs. When a program has been loaded into memory but is not doing anything, OS/2 can discard the program's code segments and swap its data segments to disk. The program then takes up very little memory. But when you switch to the program to use it, the code and data segments must be reloaded. This results in a disk access. If you want to keep several large programs load-

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ed and you won't tolerate any disk access when switching among them (and if RAM prices drop to a reasonable level), you'll want at least another couple of megabytes.

People will run OS/2 with various amounts of memory depending on the applications they run, their work habits, the performance they want from the system, and the thickness of their wallets. Systems will range from 3MB on up, probably averaging in the 6 to 8MB region a few years from now.

This may sound like a lot, but it's following a normal trend. In 1980, before the IBM PC was introduced, 64K was normal on CP/M machines. By 1985, PC users were butting up against the 640K memory limit of the PC architecture. Six megabytes for 1990 is right in line.

The initial release of IBM's OS/2 1.1 has graphics device drivers for the Enhanced Graphics Adapter (EGA), Video Graphics Array (VGA), and the IBM 8514/A. Color Graphics Adapter (CGA) support is expected in a set of device drivers that IBM is scheduled to distribute at the end of February 1989. (The IBM monochrome board is not capable of graphics and thus cannot be used with the Presentation Manager.)

In time, manufacturers of other video boards are expected to develop and distribute their own device drivers for Presentation Manager, just as they do today for *Microsoft Windows*. From the perspective of application programs, the Presentation Manager has a device-independent graphics interface. If a device driver is available for a particular video display adapter, all programs written for the Presentation Manager can use it without any changes.

The CGA (black-and-white with 640- by 200-pixel resolution) is the minimum requirement for a Presentation Manager video board. But the practical requirement is an EGA, with 640 by 350 resolution and 16 colors. Higher on the scale is a VGA, increasing the resolution to 640 by 480.

Because the Presentation Manager works with graphics, performance will be improved by video boards with hardware-assisted drawing. The first such board with a Presentation Manager driver is the IBM 8514/A (1,024- by 768-pixel resolution with 256 colors). This is not the last word in video adapter technology.



Figure 1: *When OS/2 1.1 boots from the hard disk, it switches the display to a graphics mode and loads several programs. The Start Programs window in the center of the screen allows you to choose a program to run. The icons at the bottom of the screen represent the DOS compatibility session, the Printer Spooler Queue Manager, and the Task Manager.*

For a hard disk, the minimum requirement is 10MB. But OS/2 1.1 itself occupies 8MB of hard disk space, and you'll want to reserve a couple of megabytes for disk swapping, so this is a real minimum and leaves no room for applications! A practical requirement would depend on the size of the applications you'll be using. A 30 or 40MB hard disk will be fine for many users, but 80 to 120MB would be safer.

You'll also want a mouse for the Presentation Manager. While the system has a complete keyboard interface (and most Presentation Manager programs will also), a mouse certainly adds to the ease of use.

Another desirable hardware option is a printer capable of graphics. As with video boards, the device-independent graphics interface of the Presentation Manager will allow all Presentation Manager programs to use a printer for which a device driver is available. The initial release of OS/2 1.1 included only one device driver that supports the IBM Proprinters I and II, but this deficiency is obviously only temporary. For example, a PostScript driver for the Presentation Manager is expected soon.

FIRST ENCOUNTERS Assuming that OS/2 1.1 is the current version when you decide to move from DOS to OS/2 (which will probably not be the case), here's what you'll find when you open the box and install the system.

The IBM OS/2 1.1 package consists of five high-density diskettes and one binder containing several manuals. The package is available with either 5¼-inch diskettes (for the IBM PC AT and the XT Model 286) or 3½-inch diskettes (for the IBM PS/2 Models 50 and above). The documentation includes a 159-page *Getting Started* manual, a 281-page *Using the System* manual, a 176-page *Command Reference*, and a 54-page *System Editor* manual (covering a new full-screen text editor).

Installation of OS/2 1.1 on a hard disk is fairly easy. You boot up the installation diskette and follow the instructions. This takes about 20 minutes. Most files on the distribution diskettes are in a packed format, so it would be difficult to install OS/2 1.1 without the installation program. The installation creates several subdirectories on your hard disk, copies files from the diskettes, and unpacks the files.

After the installation you can boot OS/2 1.1 from your hard disk. Midway through the boot process, the screen switches to a graphics mode. A window and several icons appear, as shown in Figure 1. This is the Presentation Manager session.

The program in the center of the screen is labeled Start Programs. This window lists the programs currently installed to run under OS/2. You can run one of these by moving the reverse-video highlight with the keyboard and pressing Enter, or by using a mouse to double-click (pressing the mouse button twice in succession) the program you want to run.

The programs installed on the Start Programs window are organized in "groups." Start Programs initially displays the Main

Group, but you can switch to the Utility Programs Group from the menu. The menu also lets you add and delete groups and add and delete installed programs within a group.

The Main Group includes two items labeled "OS/2 full-screen command prompt" and "OS/2 windowed command prompt." These start up the OS/2 CMD.EXE program (the equivalent of COMMAND.COM in DOS) for entering OS/2 commands or running OS/2 programs from the command line prompt. You can run CMD.EXE in either a separate full-screen character-mode session (as in OS/2 1.0) or in a text window in the Presentation Manager session. Figure 2 shows several copies of CMD.EXE running in different windows.

As is the case with CMD.EXE, most programs written for OS/2 1.0 can be run in their own full-screen sessions or in text windows in the Presentation Manager session. OS/2 1.0 programs cannot take advantage of Presentation Manager graphics and other aspects of the user interface. Programs prohibited from running in a text window are those that write directly to video display memory and those that install monitors or subsystems.

Using either the keyboard or the mouse, you can switch among windows, move or resize windows, "maximize" a window to fill the whole screen, "minimize" a window to be displayed as a small icon, or "close" the window (which terminates the program).

The icon at the lower right corner of the screen is the Task Manager. You can display the Task Manager window at any time by pressing Ctrl-Esc. (If you're currently in a character-mode session, OS/2 will switch to the Presentation Manager session when you press Ctrl-Esc.) Within the Presentation Manager session, you can also enable the Task Manager by double-clicking the icon with the mouse.

The Task Manager displays the names of all currently running programs, as shown in Figure 3. You can switch to one of these programs by using either the keyboard or the mouse. For a program running in a character-mode session, OS/2 will switch to that session. For programs in the Presentation Manager session, the program that you switch to will be moved to the top of all the other windows.

The icon at the lower left corner of the screen is labeled DOS. Double-clicking this icon with the mouse (or selecting "DOS command prompt" from the Task Manager) switches to the full-screen DOS compatibility mode session, which you can use for running most DOS programs. The remaining icon displays a little image of a printer. This is the OS/2 print spooler program. Its window lists all print jobs currently queued or being printed.

Three other Presentation Manager programs are included with OS/2 1.1 and can be run from the Start Programs window. *Introducing OS/2* is a short tutorial that takes you through the basics of the interface. The Control Panel (listed in the Utility Programs group) lets you set the system date and time, change system defaults (such as the screen colors), and install printer drivers and font files.

The File System (shown in Figure 4) is the most sophisticated Presentation Manager program included in OS/2 1.1. This program displays a directory tree and lets you open multiple directory windows that list the files in the directory. Menu commands let you perform the equivalents of many OS/2 file commands. Some file operations can be performed without help from the menu. For example, you can move files from one directory to another by opening two directory windows, selecting the files you want to move, and then dragging the files with the mouse to the destination directory window.

At almost any time, help is available by pressing F1. Help windows display text in the default Presentation Manager font, an easy-to-read, proportionally spaced Helvetica. A help window from the File System is shown in Figure 5.

Although the programs included in OS/2 1.1 are functional and do what they're supposed to do, some of them—in particular, Start Programs, Task Manager, File System, and Control Panel—are not quite ready for prime time. They are certainly not shining examples of what can be done in the Presentation Manager and still need some work before they function in a truly natural and intuitive fashion.

For example, the Task Manager and Start Programs windows, which perform completely different functions, look very similar and often list some of the same programs, which makes them easy to confuse. The installation of printers in the Control Panel is a total disaster. The File Manager has some good ideas, but I get frustrated every time I try to use it.

The initial release of OS/2 1.1 also lacks some essential pieces, such as graphics printer drivers for anything except the IBM Proprinters I and II. (As of this writing, some additional printer drivers for IBM printers are expected from IBM shortly.) Microsoft is working to get printer drivers written for non-IBM printers, but it is still not clear to me how these drivers will be distributed.

For most users, these problems are irrelevant. The deficiencies are so obvious that I'm sure everyone at Microsoft and IBM knows of them. By the time most users get their hands on the Presentation Manager, these programs will be fixed.

What is much more important, of course, is the Presentation Manager API (application program interface). This is what programmers must work with to write applications for the Presentation Manager.

THE PROGRAMMER'S VIEW The primary purpose of the OS/2 Presentation Manager is to provide a platform for applications written specifically to its API. While most users will not encounter the Presentation Manager until these programs are written, programmers must look at the Presentation Manager much earlier. Obviously, the applications that they write will determine how users will eventually encounter the Presentation Manager.

Programmers approaching the Presentation Manager API as their first graphical user interface will find a system that is very big, initially confusing, and conceptually difficult. The API is big because it adds about 500 function calls to OS/2. These are divided almost equally between the two main components of the system: the windowing and user interface component, and the Graphics Programming Interface (GPI).

The Presentation Manager API is initially confusing and difficult because, like most graphical user interfaces, it is based on an "event-driven" or "message-driven" model. This differs considerably from

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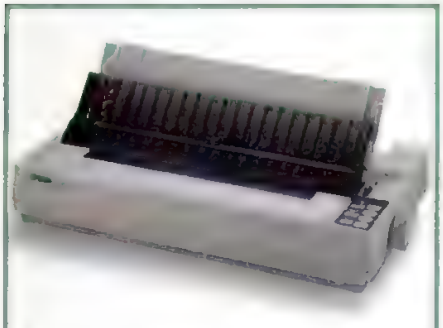
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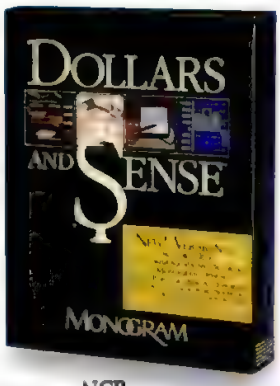


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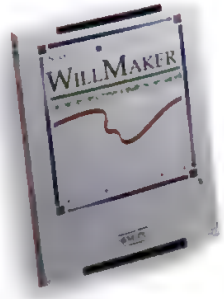
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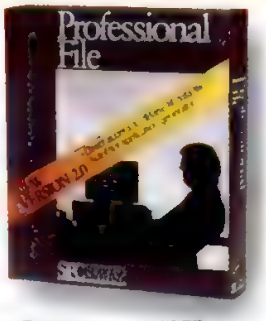


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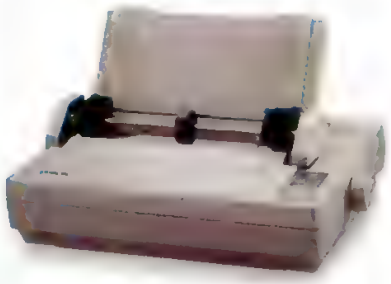
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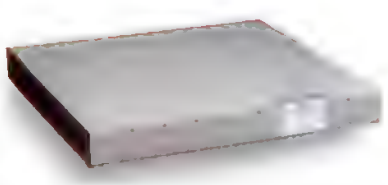
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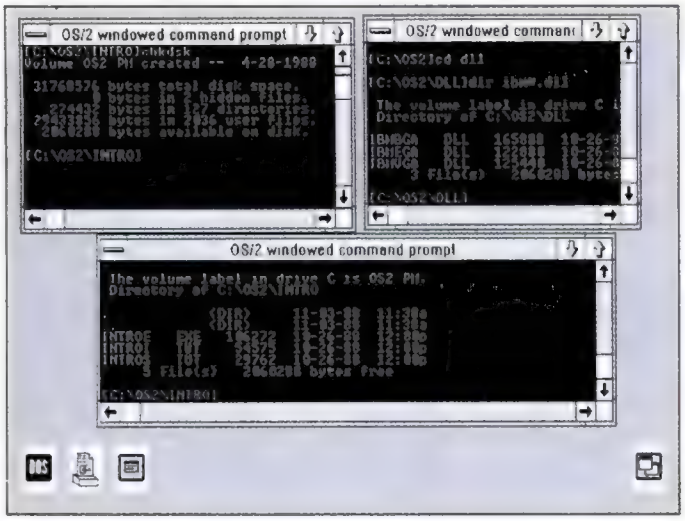


Figure 2: *Most OS/2 character-mode programs can be run in "text windows" in the Presentation Manager session. Here, several copies of CMD.EXE (the OS/2 command processor similar to COMMAND.COM in DOS) are running in separate windows.*

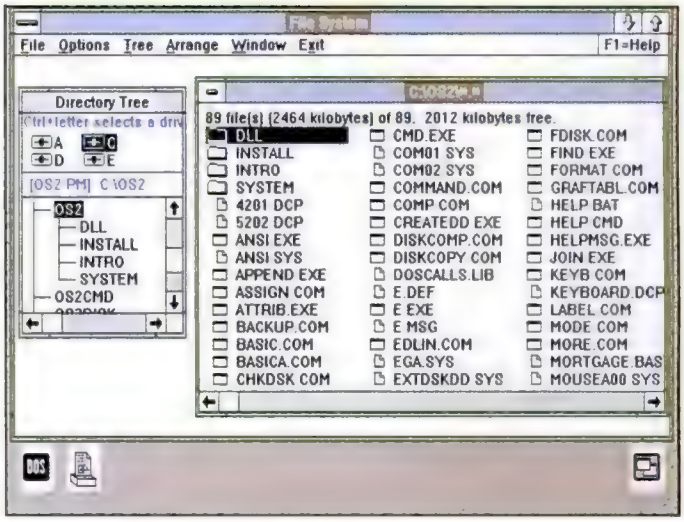


Figure 4: *The File System program included in OS/2 1.1 displays a directory tree and lets you open directory windows that show the files in the directory. You can perform many file management tasks (such as copying and deleting files) from the File System menu.*

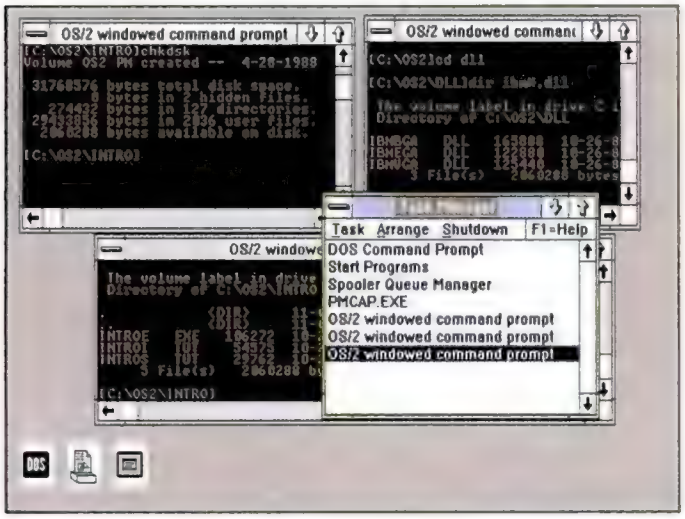


Figure 3: *The Task Manager displays a list of all programs currently running under OS/2. You can switch to a program by moving the reverse-video cursor to the name of the program and pressing Enter, or by double-clicking the program name with the mouse.*

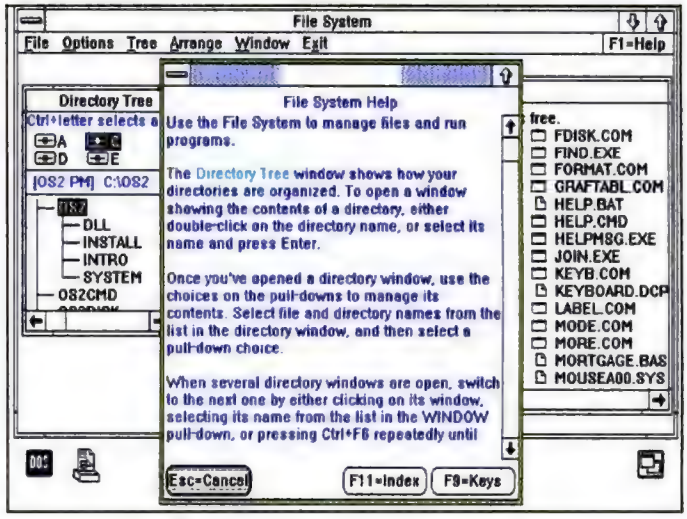


Figure 5: *The programs included in OS/2 1.1 display help windows when you press F1. The text uses an easy-to-read proportionally spaced Helvetica font. The buttons at the bottom are used to display an index of the help information and a list of special keys.*

the "top-down" model that most programmers are accustomed to, and it requires some mental reorientation. The relationship between a Presentation Manager program and the operating system is simply not the same as (and is significantly more complex than) the program/operating system relationship in more conventional environments.

Programmers experienced with *Windows* have a head start. They will find much familiar territory in the Presentation Manager API. The APIs of the two systems are similarly structured, but they differ in nearly all the details, particularly in the graphics language. The big distinction between *Windows* and the Presentation Manager is that *Windows* is an add-on to DOS (which inhibited some software manufacturers from considering a *Windows* product), while the Presentation Manager is an integral part of OS/2.

Programmers acquainted with other GUIs (such as the Apple Macintosh, *GEM*, or the Unix X Window system) will also find some familiar concepts, but many new ones as well. The Presentation Man-

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ager and *Windows* go further than most GUIs in implementing a more object-oriented environment.

When a Presentation Manager program first begins execution, it performs some necessary initialization (in particular, creating a window for the program) and then remains dormant while awaiting messages from the operating system. These messages inform the program of significant events. Some messages signal user input from the keyboard and the mouse. Other messages come from the program's menu or other user interface objects such as scroll bars. The program also receives a message when the user has resized the program's window or when part of the surface of the program's window has to be updated. Working with this message-driven structure is a significant hurdle for the programmer.

I suspect it will take a couple of years for programmers to become suitably familiar with OS/2 and the Presentation Manager to begin exploiting its full potential. (This delay is normal. For example, although the very first version of DOS released in 1981 could support RAM-resident programs, commercial products using this technique did not become prevalent until 1984.)

With experience, the Presentation Manager API reveals itself to be extraordinary, well crafted, and elegant. For most tasks that a program must perform, the API maintains a careful balance between ease, power, and versatility. Overall, it is perhaps the best API ever implemented for a graphical user interface environment. GPI, in particular, is a very powerful graphics programming tool.

There are a few minor flaws in the API, of course, but that's to be expected. In real life, perfection is rarely achieved. The API also lacks a few helpful high-level items, such as multiline edit controls (supported under *Windows)* and a standardized File Open dialog box (which the Macintosh has).

THE BASE OPERATING SYSTEM

Because the Presentation Manager is part of OS/2, programs written for the Presentation Manager benefit from the strength of the base operating system.

OS/2 uses the protected-mode operation of the 80286 and 80386 microprocessors to make available a 16MB physical address space. The implementation of virtual memory also allows each application to use much more memory than is physically available.

OS/2 is a multitasking operating system, obviously an important feature for a graphical user interface that can run several programs at once. Unlike that of *Microsoft Windows,* OS/2's multitasking is preemptive and priority-based. OS/2 also has other operating-system support necessary

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for multitasking, such as file sharing and protection, and semaphores that help coordinate access of resources by multiple applications.

OS/2 programs can themselves take advantage of OS/2's multitasking by creating multiple threads of execution, each of which can run concurrently. It turns out that multiple threads are particularly useful in a graphical user interface. The messaging architecture of the Presentation Manager sometimes inhibits normal preemptive multitasking because all messages related to user input must be serialized (processed one after another, or nonconcurrently). Programs can get around this limitation by creating additional threads of execution that carry out work independently of the messaging architecture. This results in a much smoother and more efficient overall operation of the system.

INTERPROCESS COMMUNICATION

One particular strength of OS/2 1.0 was the support of various types of interprocess communication (IPC). These include shared memory, system semaphores, Unix-style pipes, and queues.

OS/2 1.1 adds three more forms of IPC to this collection. First, "named pipes" are now a part of the base operating system rather than only part of Microsoft's *LAN Manager*. While named pipes are the most important form of IPC over a local area network, they may also be used by programs running on the same machine.

The second form of new interprocess communication is the Presentation Manager clipboard. This is a form of shared memory that assists in cut-and-paste operations between programs. Under user control, a program can copy data in a specific format to the clipboard, and other programs (or the same program) can retrieve this data and paste it into its document file.

Dynamic Data Exchange (DDE) is a form of interprocess communication originally developed for *Microsoft Windows* that is also supported under the Presentation Manager. DDE is based on the messaging architecture of the Presentation Manager. It allows programs to send out requests for information from other programs (perhaps even programs that the requester is not familiar with) and receive this information through messages.

THE CONSISTENT USER INTERFACE

The Presentation Manager establishes (but does not impose) a consistent user interface for programs. All the logic that implements menus, dialog boxes, buttons, scroll bars, and so forth is built into the Presentation Manager. All menus in Presentation Manager programs function the same way because they use this common code.

If *Windows* is any indication, programmers who write applications for the Presentation Manager will go further by styling their programs' menus on those of existing programs. For example, many programs (such as word processors, spreadsheets, and so forth) work with files. The recommended practice in *Windows* and the Presentation Manager is to name the first item on the program's menu "File." This option invokes a pull-down menu with an Open option that displays a dialog box to open a new file. The keystrokes Alt-F-O will always invoke a dialog box to open a file regardless of the program.

Although some people fear that this consistent user interface will cause application programs to become overly similar and bland, this has not been the case in Macintosh or *Windows* software. What actually happens is quite different: the Presentation Manager takes care of the more mundane aspects of the user interface, leaving the programmer free to spend more time where it really counts.

PC MAGAZINE FACT FILE



OS/2 Standard Edition 1.1
IBM Corp.
Contact your local authorized IBM dealer.
List Price: $340 (free upgrade from OS/2, Version 1.0)

Requires: 2MB RAM (2.5MB when a DOS compatibility session is used), 8MB available hard disk space, IBM 80286- or 80386-based personal computer, IBM graphics adapter and display.

In Short: OS/2 1.1 includes the Presentation Manager, a graphical user interface with a powerful and well-designed API. However, the OS/2 1.1 package is marred by some design flaws, rough edges, and unfinished business in the included programs. Not copy protected.

CIRCLE **423** ON READER SERVICE CARD

DEVICE-INDEPENDENT GRAPHICS

DOS is so weak on even text output that many programmers ignore the operating system and the ROM BIOS and write output directly to the screen. For graphics, writing directly to the screen is nearly a necessity. Over the years this has caused problems, since programs must struggle to keep up to date with emerging graphics standards.

The situation with printers is even worse. Most DOS word processing programs these days come with one or two diskettes filled with nothing but small files, each one for a particular printer.

Presentation Manager's device-independent graphics system, GPI, makes this collection of files no longer necessary. Presentation Manager programs use GPI for all text and graphics output. Device drivers take care of translating the graphics to a particular output device.

GPI is largely derived from IBM's Graphics Data Display Manager (GDDM) mainframe graphics system, with some extensions inherited from *Windows*. Quite simply, GPI is the most sophisticated and powerful graphics system available for small computers (with the possible exception of *Display PostScript*). GPI goes far beyond the graphics systems in other popular windowing environments, such as the *Windows* Graphics Device Interface (GDI), Macintosh *QuickDraw*, and the Unix X Window system, and even beyond more dedicated graphics programming languages such as the two-dimensional implementation of the Graphical Kernel System (GKS).

Here are a few features for graphics aficionados: GPI supports both image-based and vector-based fonts; a variety of curved lines (ellipses, Bezier splines, and quadratic interpolations); a hierarchy of coordinate spaces with matrix transforms between them; rectangular and arbitrary nonrectangular clipping; PostScript-style paths (used for filling, clipping, or thick stroking with ends and joins); alternate and winding area fill modes; all 256 possible raster operations for displaying a bitmap combined with a pattern on a surface; color

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table (palette) support; retention of graphics drawing orders in segments; and metafiles that retain the current graphics state as well as drawing and attribute commands.

That such a rich graphics system is included in OS/2—and available to every program that uses the Presentation Manager API—is still, to my mind, astonishing.

LAURELS AND ADMONITIONS People who enthuse about the direction that IBM and Microsoft have taken with OS/2 (and I am obviously one of these people) see the Presentation Manager as a important evolutionary step for the industry that has grown up around the IBM PC. As a successor to DOS and a competitor of everything from the Apple Macintosh to Sun workstations, OS/2 and the Presentation Manager must help bring the PC into the modern age.

Most important, IBM and Microsoft have done a really fine job with the Presentation Manager API. This is obviously the critical part of the system, and it's in good shape. In contrast, the various programs included in the retail release of OS/2 1.1 obviously need some more work. These are the programs that are important for using Presentation Manager. They must be easy to use and intuitive, and they must be models of good Presentation Manager programming style. They are not.

Another troublesome aspect of the Presentation Manager involves the development and distribution of device drivers for video display adapters and printers. At this time it seems as if IBM is interested in supporting only video boards and printers that have IBM labels on them. The people at Microsoft have taken a much greater interest in getting printer drivers written, but it is not clear at this time how these drivers will be distributed. I think that IBM and other hardware manufacturers that sell OS/2 should be involved at least in the distribution (if not the development) of these device drivers.

OS/2 and the Presentation Manager have taken a lot of flak regarding the hardware (particularly memory) required to run the system with reasonable performance. This is partially the result of OS/2's being released at a time when memory prices are very high. But certainly no one at IBM or Microsoft can claim that the OS/2 and Presentation Manager code is as memory efficient as possible. This is another area where more work should be done, even if it's likely that memory prices will be more reasonable by the time most users are ready for OS/2.

It strikes me that it would truly be a shame if the success of a system as fine as this one were compromised by something as trivial as memory chips. PC

Charles Petzold is a contributing editor of PC Magazine.

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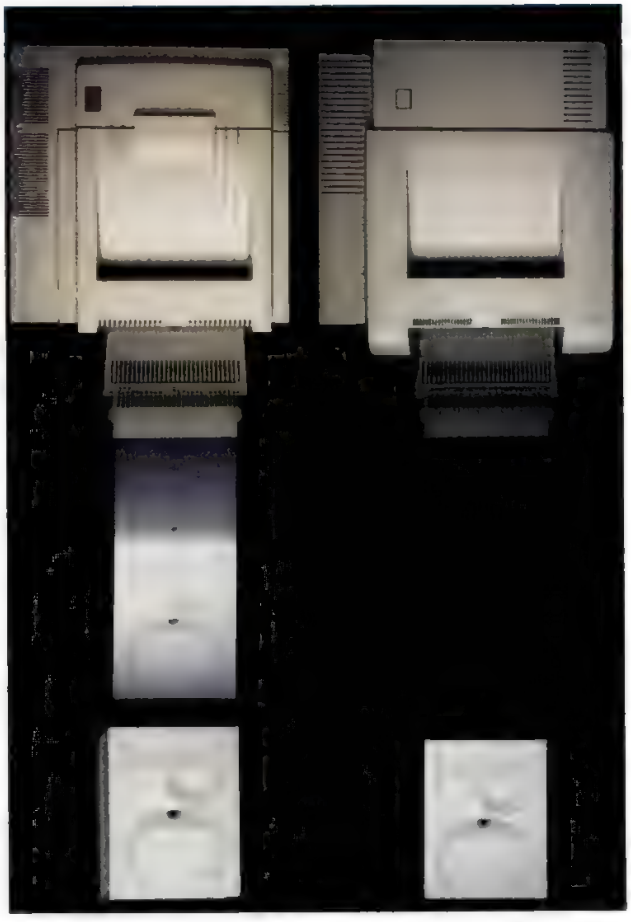
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Post-Purchase PostScript

Adding PostScript to your LaserJet is more than just an inexpensive way to get fancy typesetting. The speed improvement over an Apple LaserWriter can be startling.



Photograph: Carl Fistow

You say you bought a Hewlett-Packard LaserJet Series II for desktop publishing, and now all the graphic artists around the shop have been kicking PostScript sand in your face? Do you long for the infinite control of PostScript outline fonts but can't stretch your budget to accommodate a new PostScript printer? If this is what's troubling you, put your mind at ease, because help is here.

In its original state, Hewlett-Packard's old reliable is quite capable of handling the great majority of the desktop publishing tasks that will ever be thrown at it in a typical business setting. Still, PCL, the LaserJet's native printer control language, has its limitations, and there are certainly times and places that call for PostScript.

You need a PostScript printer if you send your final copy to a high-quality Linotronic typesetter and you want to create good-quality page proofs from the same code, for example. Or, if you are doing full-page presentation graphics, you need PostScript if you want to print at more than the 150-dot-per-

inch resolution that is practical on the LaserJet. And many desktop publishing programs have better drivers for PostScript than for the unenhanced LaserJet.

Whatever the reason, you don't have to chuck your LaserJet and start over with a new printer. Today, a number of solutions, both hardware- and software-based, bring the power and flexibility of PostScript to your LaserJet. By taking advantage of the Series II's expansion slot and enhanced features, you can pump it up into a typographic powerhouse that's even faster than a standalone PostScript printer. And all it takes is an open slot in your computer, a few free megabytes of disk space, and 3 minutes with a screwdriver. Plus, of course, a fair amount of cash—about $2,300, give or take $500, which will buy any of the six systems tested here.

A CUSTOM CONNECTION Physically, all six of these products look remarkably similar, being made up of the same basic components: a board that you install in an unused expansion slot in your computer; another, much smaller board that fits into the expansion slot on your LaserJet Series II; and a custom cable that connects these two cards. Special software drivers help them all work together.

The board that goes in your computer is the brains of the whole operation. It is essentially a single-board PostScript controller, built around an independent microprocessor supported by 2MB or 3MB of RAM (in some cases expandable to 6MB). Most of the cards use a Motorola 68000 microprocessor. The exceptions are the Conographic system, which uses a proprietary CPU, and the Princeton Publishing Labs system, which uses an advanced RISC processor that gives it a considerable boost in speed.

The system memory stores the PostScript software and interprets the PostScript commands that define the format of the page. It also stores the font outlines and is used both as a workspace for holding the individual characters as they are formed from the font outlines and for holding the image of the page as it is formatted.

As a page is created, it is sent out to the printer through a high-speed video port that is connected directly to the printer's laser imaging system, through a second board installed in the printer's expansion slot (located behind a small oblong plate to the left of the regular port connectors). Consequently, these systems are capable of much better resolution than a stock LaserJet because they are not limited by the printer's memory.

OPERATIONAL DIFFERENCES Of the six products reviewed here, only the QMS JetScript uses the genuine PostScript language licensed from Adobe Systems, the developer of the page description language. The other manufacturers chose instead to use one of the recently released PostScript clone products. In our testing, we did find some evidence of incompatible behavior on the part of some of the clones, but overall they seemed to do as well as the true-blue Adobe product.

The products can differ significantly in their operation, however, depending on how the PostScript code is treated. Most of the systems tested here can be configured to take over one of your DOS printer ports (LPT1 through LPT3), allowing them to be used directly from any application that can send a stream of PostScript code to a printer. Another, less convenient, approach is to print your PostScript code to a disk file and then process it with a separate PostScript interpreter program to get a printed page. Since the PC Labs benchmark tests were run using PostScript files that had been printed to disk, you should be aware that these products might perform differently when printing directly.

■ These boards produce blazing times for graphics and give up but little to an unadulterated LaserJet in text speed tests.

In any case, these boards are fast, producing blazing times for graphics, while giving up little to an unadulterated LaserJet Series II in text speed tests. On PostScript graphics, the differences are especially dramatic: a job that required between 25 and 30 seconds for the fastest add-in boards to handle ate up over 18 minutes on the 68000-based Apple LaserWriter NT, and a full 7 minutes on the 68020-based LaserWriter NTX.

A REAL BARGAIN But what do you give up by adding PostScript to your LaserJet Series II, besides a couple of thousand dollars? The answer is, not much. In most cases, you can still use your printer as a LaserJet. Because the add-in boards have a custom connection between the computer and the printer, your standard parallel or serial port connection to your LaserJet is still in place. However, if you choose to go this route, be aware that you may face more work at installation time to avoid port conflicts.

If you have an XT compatible, your choices are somewhat limited, because some cards require a 286- or 386-based machine. All of the cards fit just fine in 8-bit slots, however; the two cards with 16-bit edge connectors can be configured to work in 8-bit slots without a problem. Even if your computer is an IBM PS/2 with Micro Channel expansion slots, you are not left out of the picture; a number of these manufacturers have Micro Channel versions of their products or are planning to release them in the future.

Also, be careful if you're counting on sharing your newly PostScript-compatible printer. Some of the boards do not work in network servers, and those that do are sometimes limited in the types of networks they support. Moreover, the nonstandard cables these products use make it certain that you will not be able to hook them to a printer switch box.

Aside from these small points, these boards turn out to be remarkably attractive buys. Not only do they run significantly faster than most PostScript printers available on the market today, but you also won't have to pay for the privilege of keeping your LaserJet. With discounted prices for the Series II running at $1,700 to $1,800, these boards let you acquire a PostScript-compatible laser printer for about $4,000. And best of all, you still have your LaserJet.

CONOGRAPHIC CORP.
ConoDesk 6000

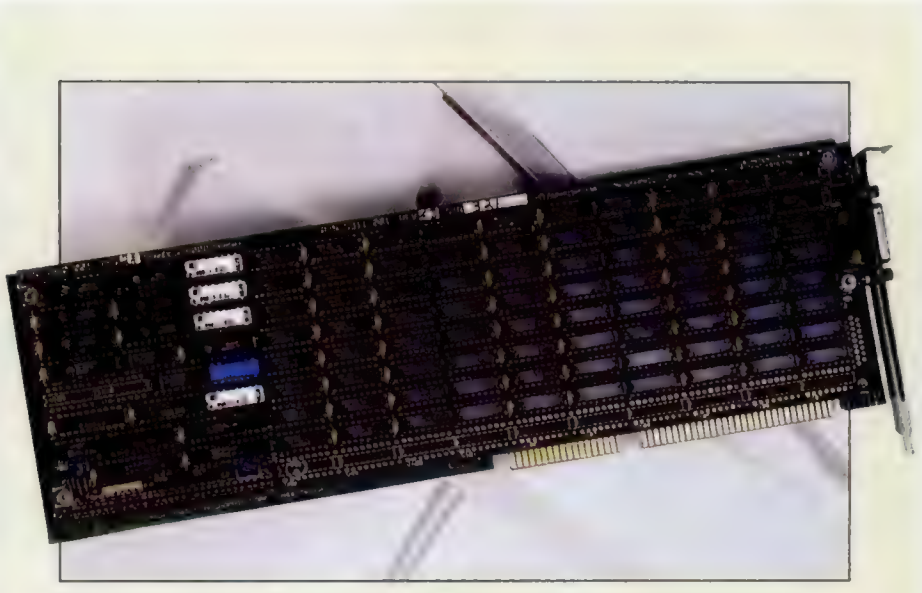
Conographic Corp. produces a number of high-performance graphics products, including high-resolution displays for desktop publishing applications. Its entry in the PostScript add-in race is the $2,695 ConoDesk 6000, a board that represents a decent value despite its high price.

The ConoDesk 6000 is based on a sandwiched expansion board built around a proprietary 32-bit microprocessor with 2.5MB of on-board memory. The board comes with a 16-bit edge connector but can be configured so that it will work in an 8-bit slot. The manufacturer recommends that you use it with a 286- or 386-based computer. The processor board connects to an HP LaserJet expansion card through a special cable. The cable has a standard 25-pin connector on the printer end and a 26-pin connector the size of a 15-pin connector on the computer end. This unusual-looking combination eliminates the possibility of confusion about which way to install the cable. Different versions of the printer adapter are available for the older LaserJet and LaserJet Plus models, as well as for the Canon LBP-II, Brother HL-8, and the Ricoh PC 6000/EX.

Installing the ConoDesk 6000 is straightforward. Before you put the processor card in your computer, you run a program that polls different parts of your computer system, searching for possible conflicts. When it has finished its search, the program shows you how to change switch settings and software parameters on-screen, eliminating frustrating trial and error in the installation process. Before you can use the ConoDesk 6000 after power-up or reset, you run a short program that initializes the card.

A pair of 1.2MB floppy disks containing the PostScript programs, font outlines, and utilities accompanies the board.

TWO-STEP PRINTING Printing a document using ConoScript, the unit's PostScript-compatible interpreter, requires two steps: First you must print out the PostScript commands to a disk file; second, you enter a command and the filename at the DOS prompt to translate and print the document. (ConoScript also allows you to issue PostScript commands interactively, for quick drawing on the fly.) According to its maker, ConoScript has been certified by an independent testing laboratory for compatibility with Adobe's PostScript, Version 47.0.



The ConoDesk 6000 ($2,695) uses a PostScript interpreter program to print documents from disk files of PostScript code.

This approach can be convenient enough if you already have the PostScript output files on-disk. But if your application program routes its PostScript output only to a standard parallel or serial port, the ConoDesk 6000 will not be able to process it. And using ConoScript requires your computer to have an 80287 or 80387 math coprocessor chip.

You can, however, print directly from *Ventura Publisher* and from *Windows* applications such as *PageMaker* by using the special high-speed custom drivers that come with the board. (You do not need the coprocessor to use the product with these custom drivers.)

In the graphics portion of the PC Labs benchmark tests, the ConoDesk 6000 was one of the faster performers. In the text portion of the tests, it was among the slower products.

Overall, the ConoDesk 6000 is a solid and easy-to-install performer, offering a full complement of PostScript fonts. On the other hand, it has the second highest list price in the pack, and it requires an inconvenient two-step process to print a PostScript document. If you can live with this, it still represents a good value in terms of features and performance.

FACT FILE

ConoDesk 6000
Conographic Corp.
16802 Aston St.
Irvine, CA 92714
(714) 474-1188
List Price: $2,695
Requires: 640K RAM, 80287 or 80387 math coprocessor (for ConoScript). Cannot be installed in network servers.
In Short: The ConoDesk 6000 is one of the fastest for printing graphics, but it is limiting in that you cannot print PostScript jobs directly from the application. If you can get your output into a disk file and you don't mind this two-step process, however, the package can be a good value.

CIRCLE **417** ON READER SERVICE CARD

DESTINY TECHNOLOGY CORP.
PageStyler

The PageStyler has the lowest price of the bunch, costing (at $1,790) about the same as the LaserJet Series II printer itself. The question is, what do you give up when you save money over the competing products?

Photographs: Thom O'Connor

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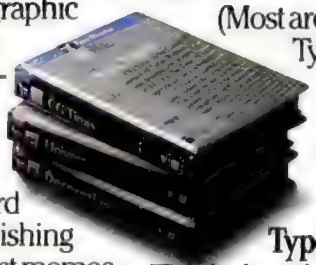
Compugraphic. One Of The Biggest Names In Type. When you think about it, it shouldn't come as a surprise. After all, AGFA Compugraphic is a supplier of typefaces to top advertising agencies, printers and publishers everywhere. Its typeface library is the biggest and best in the world, with over 1700 typefaces.

The Big And The Small Of It. A high-performance scaling technology found only in Type Director lets you make each typeface bigger or smaller until it's the exact size you want, from a tiny 4 points to a huge 200 points. But no matter what size you finally do decide on, each character will be crisp, clear and handsome.

We've Seen To It That There Are No Surprises. When you're using Type Director, you see the characters on your screen exactly as they'll appear in your output. There are no surprises when you print out the results. And you get the fonts you need in just a few moments—decidedly more quickly than with any other software available today.



You'll Wonder How You Managed Without It. What is Type Director's impact on the fonts you're using now? Not to worry. Type Director will easily manage any "soft fonts" you may have as long as they're Hewlett-Packard LaserJet compatible. (Most are.) By converting to Type Director, you protect your investment while making your desktop publishing system much more flexible and useful.



Type Director Does It All. Think about it. Type Director lets you generate characters, monitor and manage your library of typefaces, automatically install them in your application, and immediately send them to your printer—all by touching just a few keys.

Learn By Doing, Not By Reading. Type Director is incredibly simple to use. It's entirely menu-driven, so there's no thick manual to have to hunt through. All you do is respond to the prompts on the screen. A built-in HELP function handles any questions that may arise.

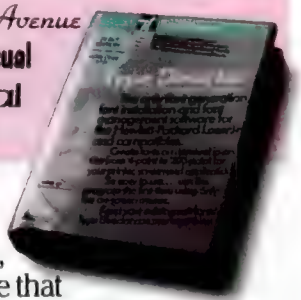
Type Director Compatibility Information.
Type Director is fully compatible* with the following: COMPUTERS: IBM XT, AT, Personal System/2 and compatibles with hard disk, 640K bytes RAM, running MS-DOS or OS/2. PRINTERS: Hewlett-Packard LaserJet PLUS; LaserJet 500 PLUS; LaserJet 2000; LaserJet Series II; LaserJet II D and compatibles. APPLICATIONS/ENVIRONMENTS: Aldus PageMaker 1A and 3.0; Xerox Ventura Publisher 2.0; Microsoft Word 4.0 and 5.0; Microsoft Windows 2.03 and 2.1; WordPerfect 5.0; Other software programs supporting LaserJet "soft fonts". DISPLAYS: VGA; CGA; EGA; Hercules Monochrome; AT&T 6300; Xerox PC Full Page Display; WYSE 700 Graphics; Compaq; Monochrome; Hi Res Monitor (96x96); Hi Res Monitor (100x100).
*For compatibility information on unlisted printers, displays and applications, phone 1-800-873-FONT.

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- Vol. 3 From the Decorative collection:
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 - Dom Casual
 - Uncial
 - Brush



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CIRCLE 200 ON READER SERVICE CARD

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■ POSTSCRIPT ADD-IN BOARDS



As it comes from the box, the $1,790 PageStyler from Destiny Technology Corp. has enough memory for only 13 font outlines.

One thing you don't give up is ease of installation and use. The PageStyler installation program copies the three diskettes of files to your hard disk and either steers you through the default settings or examines your hardware to help you make custom settings easy to determine. The manual is well written, and its pages are attractively designed with ample white space, plenty of screen shots, and clear illustrations. It should give even the most timid novice the confidence required to tackle such daunting topics as DIP switch settings and IRQ interrupt choices.

You can use the PageStyler with any program that can send PostScript output to a printer port. The manual gives instructions on how to select the PostScript printer driver to use with the most popular application programs. It can be installed in TOPS and 3Com network file servers.

While the PageStyler does not come with standard Adobe fonts such as Times Roman or Helvetica, it does support their Bitstream equivalents: Dutch and Swiss. And it can even append the Adobe names to these fonts to make sure that your applications can recognize them.

WHERE'S THE CATCH? So what do you give up?

First of all, you must compromise on the number of usable fonts. The PageStyler comes with only a bare minimum of 13 font outlines. If you want the other 22 outlines found in most PostScript printers, you must add a 2MB memory upgrade.

Worse, you give up time. On an 8-MHz IBM PC AT, the PageStyler takes about 2 minutes to initialize and load its fonts, and you do not see a DOS prompt until it is finished. Even then, you must wait an additional minute or so before the initial test page comes out of the printer. When it comes to actual print jobs, the PageStyler

PC MAGAZINE FACT FILE

PageStyler
Destiny Technology Corp.
300 Montague Expressway
Milpitas, CA 95035
(800) 874-5553
(408) 262-9400
List Price: $1,790
Requires: No RAM required (comes with 2.5MB RAM of its own); HP LaserJet Series II printer. Can be installed in TOPS or 3Com network servers.
In Short: The PageStyler has a low price, but it suffers from a lack of font outlines and slower performance than that of its competitors. More appealing alternatives are available.

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	Type Director Debut Edition, OS/2 (Includes 12 Typefaces: Volumes 1,2,3)	$225
	Type Director Font Management Program (Includes 2 Typefaces: CG Times, **Univers Bold**)	$95
	Vol. 1: CG Times†	$195
	Vol. 2: Univers†	$195
	Vol. 3: Decorative† (See ad)	$195
	Vol. 4: CG Triumvirate†	$195
	Vol. 5: Univers Condensed†	$195
	Vol. 6: Futura II†	$195
	Vol. 7: Microstyle†	$195
	Vol. 8: Decorative† ❦ ◗ ★ (ITC Zapf Dingbats 100,200,300)	$195
	Vol. 9: CG Century Schoolbook†	$195
	Vol. 10: ITC Benguiat†	$195
	Vol. 11: ITC Lubalin Graph†	$195
	Vol. 12: ITC Avant Garde Gothic†	$195
	Vol. 13: ITC Souvenir†	$195
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*Prices stated in U.S. dollars and subject to change without notice.
†All products come with MS-DOS & OS/2 compatible diskettes unless otherwise noted. Each volume contains 4 typefaces from the family listed unless otherwise noted.

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CIRCLE 728 ON READER SERVICE CARD

■ ADD-IN BOARDS

was one of the slowest on the graphics test and was merely in the middle of the pack on the text speed test.

The PageStyler looks like a great deal with its low price. But in the end, when you start comparing performance and features with other competing products, you'll find that faster printing and a full set of fonts don't cost much more.

EICON TECHNOLOGY CORP.

EiconScript Card

The $2,075 EiconScript Card from Eicon Technology is an interesting but flawed product.

It has many good points. It is relatively easy to install, and because it can be addressed as one of the parallel ports, it can be used with almost any program. It can be installed in the file server for any MS-DOS-based network. Its PostScript clone interpreter has a full complement of 35 font outlines. It comes with 2MB of memory, and you can add up to 2 more megabytes by installing a daughtercard, at a cost of $600 per megabyte.

Like the other add-in boards in this review, the EiconScript uses a video interface to send the page image to the printer.

PC MAGAZINE FACT FILE

EiconScript Card
Eicon Technology Corp.
2196 32nd Ave. (Lachine)
Montreal, Quebec
Canada H8T 3H7
(514) 631-2592
List Price: PC version, $2,075 USD; PS/2 version, $2,275 USD
Requires: Card carries 2MB RAM on board but needs 4MB RAM in host system and 1.5MB free hard disk space; 8- or 16-bit slot. XT, AT, PS/2, or compatible; can be installed in servers for MS-DOS-based networks only.
In Short: A full complement of fonts and the ability to send output directly to a port or to an intermediate disk file makes the EiconScript look good at first. But poor documentation, questionable quality control, and relatively low performance make this board less appealing than its competitors. Wait for the new 16-MHz version, due out soon at the same price, before considering this package.

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FRAMEWORK II

It also uses a standard parallel or serial connection for PostScript operations. But this connection can be used to send PCL commands to the printer, so you don't lose your LaserJet's native capabilities.

ERRORS OF OMISSION But the EiconScript suffers from problems of execution, such as inadequate documentation. One step in the installation requires you to specify what kind of printer you're using. The sneaky part is that the manual does not tell you that you have to choose the LaserJet Series II option, not the Canon SX Engine option (which the Series II is, but that's the wrong answer for the EiconScript). According to an Eicon representative, the manual is being revised and a new version should be shipping soon.

More serious were the quality problems we discovered while trying to get the package to work. In the end, a hand-delivered system worked flawlessly, but only after we spent hours fussing over two complete packages that came through the mails.

Once it was running properly, the board proved a lackluster performer at best. According to the manufacturer, the system uses a "double buffering" technique to increase its performance, holding one page in a portion of memory for conversion into a video signal at the same time that it uses another portion of memory to compose the next page. Yet though it was tested with 3MB of RAM, its graphics times still put it near the end of the pack. And in the text speed test it came in dead last, a full page per minute slower than the fastest system.

By the time this is in print, claims an Eicon representative, the company should be shipping a newer and faster version of the EiconScript card, one with a 16-MHz

PostScript Add-In Boards: Summary of Features

(Products listed in ascending price order)

All of the PostScript add-in boards we reviewed have certain features in common. Each of them utilizes a video interface connection (the number of pins on each connector is indicated in the table). And every board allows you to use your LaserJet printer as such while the PostScript board is installed.

Among the type styles included with every board are Helvetica, Times, and Courier, each offered in roman, bold, italic, and bold italic fonts. In addition, all of the boards support type styles available from third-party vendors.

	PageStyler Destiny Technology Corp. $1,790	PC Publisher Kit Series II QMS Inc. $1,995	EiconScript Card Eicon Technology Corp. $2,075	JetScript QMS Inc. $2,495	ConoDesk 6000 Conographic Corp. $2,695	PC PS-388 Accelerator Princeton Publishing Labs Inc. $2,795
Card size	8-bit	16-bit	8-bit	16-bit	16-bit	16-bit
Slot size required	8-bit	8-bit	8- or 16-bit	8-bit	16-bit	8-bit
Processor type	Motorola 68000	Motorola 68000	Motorola 68000	Motorola 68000	Proprietary	RISC
Processor speed	12 MHz	12.5 MHz	12 MHz	16.67 MHz	13.3 MHz	10 mips
Base memory	2.5MB	2MB	2MB	3MB	2.5MB	3MB
Minimum memory upgrade	2MB	N/A	1MB	N/A	N/A	N/A
Maximum memory upgrade	4.5MB	N/A	4MB	N/A	N/A	N/A
Computer connector	37-pin	37-pin	37-pin	37-pin	15-pin	25-pin
Printer connector	37-pin	37-pin	37-pin	37-pin	25-pin	25-pin
Number of type styles included	13 (22 additional type styles, $150)	35	35	35	35	35
Printer control languages supported						
Adobe PostScript	○	○	○	●	○	○
Clone PostScript	●	●	●	○	●	●
DDL	○	●	○	○	○	○
HP PCL	○	○	●	○	○	●
Other	None	None	None	None	None	Epson LQ

PC—Editor's Choice ●—Yes ○—No N/A—Not applicable: memory cannot be upgraded.

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5¼" and 3½" Diskdrive Both Standard

Incredibly convenient. The The HeadStart III has two internal drives: a 1.2 megabyte, 5.25-inch and a 1.44 megabyte 3.5-inch, both standard. So you don't have to choose between the two, you use either, depending on your software.

Incredible performance. At the heart of the HeadStart III is a 12MHz 80286 processor with one megabyte of standard RAM, with the hard drive system delivering 32 megabytes of storage operating at 28 milliseconds with astonishing 1 to 1 interleave. Plus, true 16 bit built-in VGA Graphics is component matched for high speed and clarity.

Plus, incredible expandability and support. The HeadStart III is designed for your future as well as your present applications, with four expansion slots for networking and for the diverse peripherals already becoming available. With the HeadStart III, you're OS/2 ready right now. You can add two full megabytes of RAM, without having to buy any additional boards.

In addition, our PC Coach hotline is available to registered owners with questions about hardware, software or service.

To obtain more information about the HeadStart III and our full line of advanced computer systems, or to find the name of the nearest dealer call toll free **1-800-882-1888.**

You'll see, it really is incredible.

SPECIFICATIONS

MICROPROCESSOR: Intel 80286-12
SPEED: 12MHz/8 Switchable
BIOS: Award
BUILT IN RAM: 1 Megabyte
EXPANDABLE TO: 3 megabytes
POWER SUPPLY: 145 watts 110/220 switchable
KEYBOARD: 101 key PS/2 compatible
GRAPHICS: VGA Autosync
FLOPPY DRIVES: one 5.25" 1.2 megabyte, one 3.5" 1.44 megabyte
HARD DRIVE: 32.1 megabyte, 28 milliseconds, 1:1 interleave
BUILT IN INTERFACES: Parallel, 2- RS232 serial, mouse, joystick
EXPANSION SLOTS: 3 available
MOUSE: Standard
SOFTWARE: DOS 3.3, GW Basic, HeadStart Advanced Environment, Floppy Driver, Framework II, 3-D Graphics, ATI and Computer-EEZ Tutorial Software, Xtree hard disk manager, Publish-it! Chessmaster 2000, Splash VGA paint program, Bookmark, plus Twist and Shout.

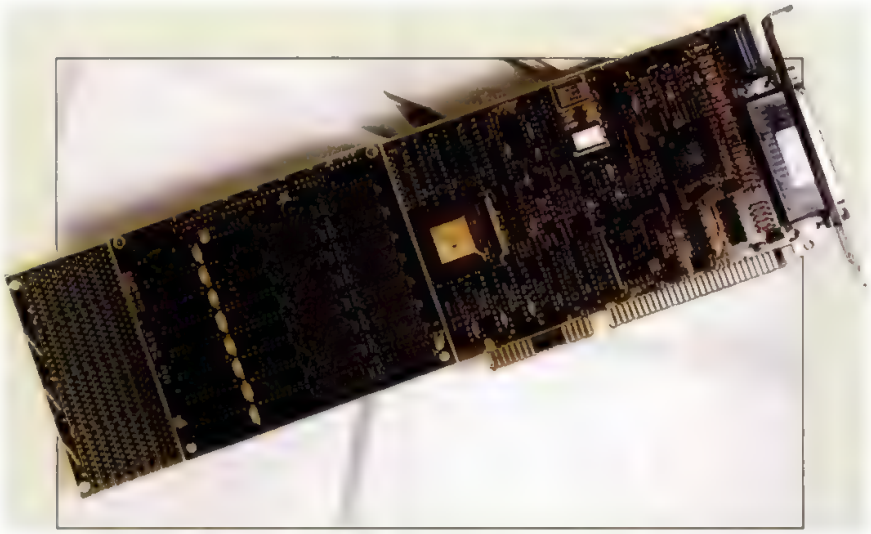
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VENDEX

HEADSTART™ III

Built to be compatible with you.™

CIRCLE 731 ON READER SERVICE CARD



The $2,275 PS/2 version of the EiconScript Card requires both a standard serial or parallel interface and a custom video interface to the printer.

68000 processor, a reversible cable, and revised documentation. The new version will sell for the same list price as the current version.

With its uneven documentation, poor performance, and questionable quality control, the EiconScript does not present a particularly attractive value as it now stands. But the planned new release may make it more competitive.

PRINCETON PUBLISHING LABS INC.

PS-388 Accelerator

The Princeton Publishing Labs PS-388 Accelerator was a latecomer to the party at PC Labs, but this just shows Fate's trick of saving the best for last.

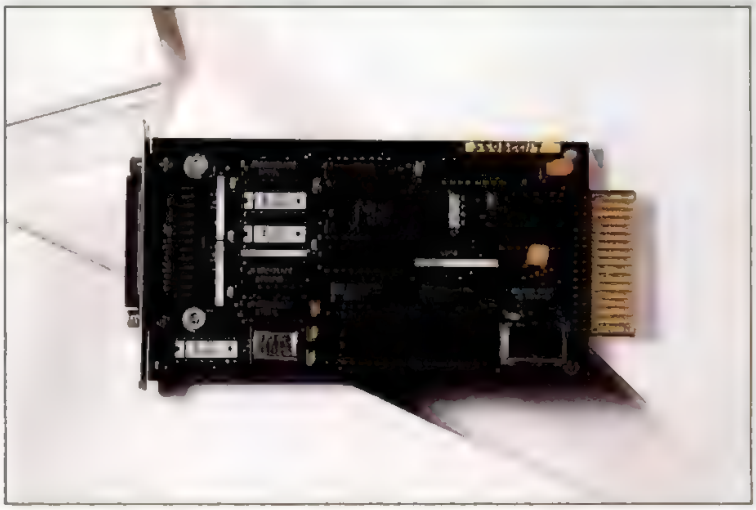
At first glance, the PS-388 looks typical of the breed. It includes a heavy, sandwiched board with lots of chips and an 8-bit edge connector, which the manual suggests can be installed either in an XT- or an AT-compatible machine. It will work in a network file server. Like the others, it connects to a simple card in the LaserJet by means of a special 25-pin cable. It comes with 3MB of memory and a full complement of 35 Bitstream font outlines. In order to maintain full compatibility with the Adobe fonts, the Bitstream Swiss and Dutch fonts can be accessed using the Helvetica and Times Roman font designations.

Installation and use is a breeze. Because you install it as a standard parallel port, the board can be used from almost any program. You won't need to worry about installing trouble-prone drivers; you can configure the board as LPT1, LPT2, or LPT3, with LPT2 as the default setting. At the same time, you don't lose your LaserJet—you can leave it hooked up to your computer through another parallel or a serial port and still access it directly using another DOS device name.

But this breeze is nothing compared to the gusts you'll feel as the pages come flying out of your printer. The PS-388 had the best overall performance of any board tested, walking away from the competition in the graphics and text speed tests, with the exception of the complex PostScript Graphic Times test, in which it placed a close second to the ConoDesk 6000. It faithfully produced all the sample pages and did not appear to have any problems with the test files. Compared to a standalone PostScript printer, this combination is unbeatable.

RISC IS THE ANSWER The PS-388's secret lies in its dedicated RISC processor, developed by Weitek specifically for PostScript controllers. According to information from Princeton Publishing Labs, the processor is capable of 10 mips (million instructions per second), which far outstrips even the most powerful PC. This advanced technology gives the card more power to convert your application's PostScript commands into an image and then into video signals for the printer.

If the PS-388 has a weak link, it is its documentation. We were given a prelimi-



An advanced RISC microprocessor and ample memory push the Princeton Publishing Labs PS-388 Accelerator ($2,795) to the head of the pack.

One of the most important reasons for buying our new LaserJet IID printer is on the other side of this page.

One of the most important reasons for buying our new LaserJet IID printer is on the other side of this page.



The latest member of the HP LaserJet printer family prints on both sides of the paper. But that's just the icing on the cake.

The LaserJet IID printer is full of new ideas for making paper-handling easier and more efficient.

An envelope feeder accessory, for one. Instead of having to feed envelopes manually, our new printer does it automatically.

You wanted more paper trays. So the LaserJet IID printer has two of them, each with a 200-sheet capacity. Give us more fonts, you said. And LaserJet Series II compatibility. Done!

So now you have a choice of two HP LaserJet printers. Both with that superb quality for text and graphics you've come to expect from Hewlett-Packard.

All good reasons to call **1-800-752-0900, Ext. 297A** for the name of your nearest dealer.

HEWLETT PACKARD

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CIRCLE 326 ON READER SERVICE CARD

Shades of Compatibility, Subtle Differences

Some PostScript add-in boards are more equal than others. That's the conclusion we came to when we found subtle differences in the output produced by some of the boards on the PC Labs PostScript Graphics Times test. In fact, the QMS JetScript was the only product tested that replicated the output of an **Apple LaserWriter II**, the PostScript printer against which all the products were compared. That didn't surprise us, however: the JetScript was the only board tested that, like the LaserWriter, uses Adobe PostScript rather than a PostScript clone.

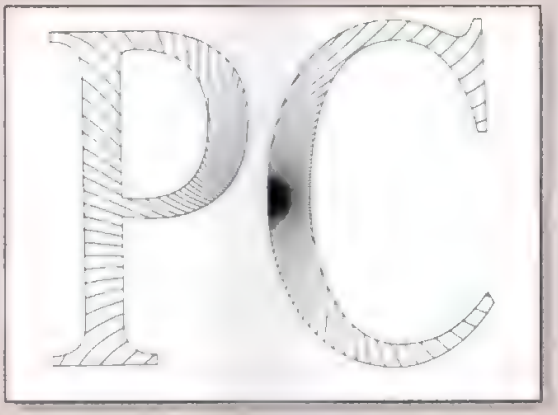
Shown here are some of the fine and not-so-fine discrepancies that can occur when you use a product that isn't completely Adobe PostScript compatible. Although our PostScript Graphics Times test was not designed to be a compatibility test, it should give you some idea of the kinds of problems you might encounter when using these products. For comparison, we've included a sample printed on the Apple LaserWriter II so that you could see how far from the mark some of these products have strayed.

The Princeton Publishing Labs **PS-388 Accelerator** board—the fastest of the group—saves time in part by using straight lines to fudge Bezier curves. But we found a less perceptible problem with the output produced by this and some other boards: they do not use the same arc spacing as does Adobe PostScript. The Destiny PageStyler, EiconScript Card, and the Princeton Publishing Labs PS-388 Accelerator use the Bitstream library of type fonts, which is width-compatible with that of Adobe but looks somewhat different

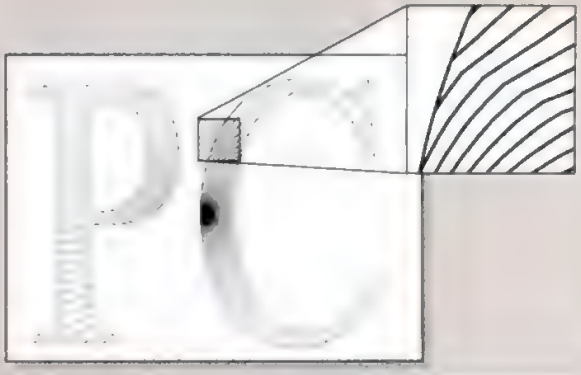
Several boards that use PostScript clones showed roughness in their font-smoothing process. You can see it in the jaggedness at the top of the "P" in the **ConoDesk 6000** graphics sample and in the top hook of the "C" in the QMS **PC Publisher Kit Series II** sample. Other boards may produce similar results with other letters.

Freedom of Press, one of the two software PostScript emulators tested, failed to properly handle the densely spaced Bezier curves near the center of our image. After 9 minutes of processing, it delivered faulty output. *Freedom of Press* also drew thinner, less-well-defined lines than the other products tested.

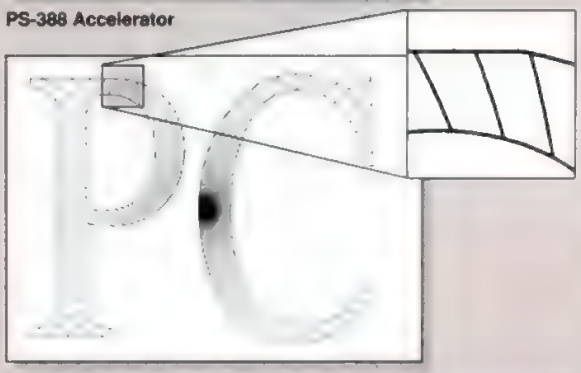
If you regularly need to produce Bezier curves or smoothly scaled fonts, you might not want to consider a product that cuts corners on these features. But if you will be generating normal-sized fonts and more common graphic elements, you may never run into these problems. Differences in implementation, such as using a type library other than Adobe's, will cause problems only if you are prototyping output destined for a true PostScript device. But these differences may be great enough to affect the overall look of your output.



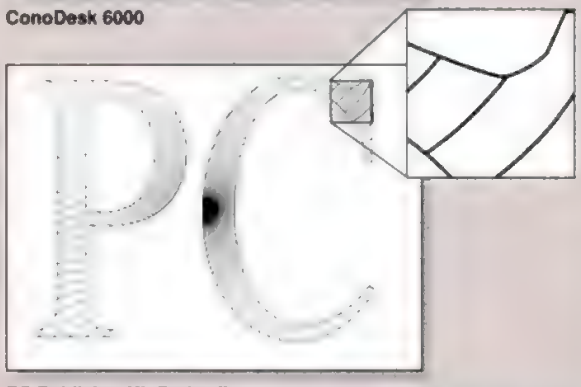
Apple LaserWriter II



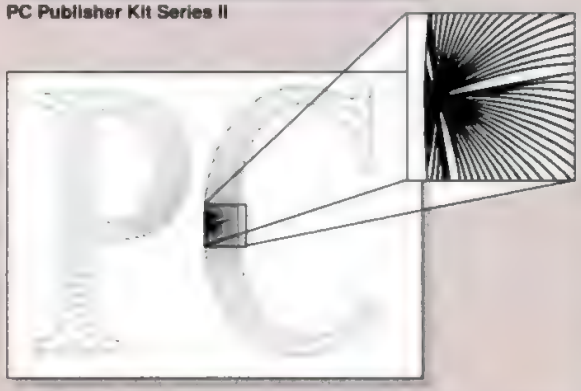
PS-388 Accelerator



ConoDesk 6000



PC Publisher Kit Series II



Freedom of Press

GETTING POSTSCRIPT THE CHEAP WAY

Two software products—GoScript and Freedom of Press—offer easy and inexpensive upgrade paths to PostScript for the printer you already own.

Like many languages, the PostScript page description language must be interpreted before it can be executed. Buying a printer smart enough to interpret PostScript code is an expensive proposition: on the average, printers that use a licensed version of the PostScript interpreter cost $2,000 more than those that don't.

However, it's possible to interpret PostScript code using your computer's processor rather than a special processor in a printer—and to save a lot of money in the process. After your computer stores the resultant bitmap image in memory, it can send the file to a non-PostScript-compatible laser, ink jet, or even dot matrix printer using ordinary drivers.

Two software products—LaserGo's *GoScript* and Custom Applications' *Freedom of Press*—let you do just that. And at prices of $195 and $495, respectively, these programs may be the cheapest implementations of PostScript for a long time to come. *Freedom of* Press duplicates the 35 fonts supplied with the Apple LaserWriter NTX, while *GoScript* mimics the 13 fonts of the original Apple LaserWriter. LaserGo is also planning to release a $395 version of *GoScript* that will handle 35 fonts.

TWO LIMITATIONS By choosing to go the software route to PostScript compatibility, you'll keep your costs down, but you'll have to accept two major limitations inherent in the technology used by *GoScript* and *Freedom of Press*. First, you cannot use either of these software translators from within your application program. While in *Ventura* or *PageMaker*, you must print your file to disk. Only after exiting the application can you print the image—but you must always do so in batch mode from the DOS prompt. Certainly, this is a drawback if you like to check your work periodically with paper proofs.

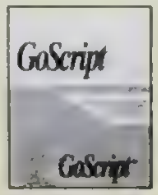
The second limitation is that you must dedicate your computer's processor to the job of interpretation and memory management. One of the reasons that the PostScript interpreter was originally built into the Apple LaserWriter was to free the computer from the time-consuming task of translating large graphics files. Both *GoScript* and *Freedom of Press* took well over an hour to print out a 5-inch-square sample halftone. While they were processing the graphics file, the computer was unavailable to any other application.

Further testing in PC Labs revealed the performance trade-offs that you must make in order to use these products. Large text files, surprisingly, took the longest to print out. In fact, both programs averaged about 1 page per minute on a 20-page document. Compare that result with the 7.8 pages per minute for the Apple LaserWriter NTX. But in spite of the fact that neither program supports Adobe's proprietary font outlines (both programs use Compugraphic and Bitstream fonts instead), the letter forms that

FACT FILE



***Freedom of Press*, Version 1.0a**
Custom Applications Inc.
5 Middlesex Technology Center
900 Middlesex Turnpike
Billerica, MA 01821
(800) 873-4367
(508) 667-8585
List Price: $495
Requires: 530K RAM, 4MB disk space, 512K EMS, DOS 2.1 or later.
Printers Supported: AVR-megabuffer, BlaserStar 2, Canon BJ130, Canon LBP, Epson LQ, Fujitsu DL, Fujitsu Laser, HP DeskJet, HP LaserJet, IBM-X24, JLaser, NE P-5, Olivetti PG108, PCL Compatible, PCPI LaserImage, Siemens PT 88S-32, Siemens PT90-12, Tandy-DMP
In Short: A PostScript interpreter that duplicates the brains and 35 fonts of the Apple LaserWriter NTX via software—at about half the speed and one-tenth the price.
CIRCLE **426** ON READER SERVICE CARD



***GoScript*, Version 2.03**
LaserGo Inc.
9235 Trade Pl., Suite A
San Diego, CA 92126
(619) 530-2400
List Price: 13-font version, $195; 35-font version, $395
Requires: 550K RAM, 1.5MB disk space, 1MB EMS, DOS 3.0 or later.
Printers Supported: Canon BubbleJet BJ 130, Canon LBP-8 II, Epson FX Series, Epson LQ Series, HP DeskJet, HP LaserJet Plus, HP LaserJet Series II, HP PaintJet, IBM ProPrinter, NEC PinWriter, Toshiba 24-pin
In Short: A PostScript interpreter that duplicates the 13 fonts in the original Apple LaserWriter. This inexpensive program doesn't offer many enhancements, but one nicety is its interactive mode, which lets you issue single PostScript commands that will be executed as you type them—a great feature for beginning PostScript programmers.
CIRCLE **427** ON READER SERVICE CARD

they produced were flawless.

Based on how long it took to print our sample text files, I fully expected to sleep at PC Labs while printing the graphics test document, but I was wrong. *GoScript* took 853 seconds—and *Freedom of Press* 543 seconds—to execute the test. That's not faster than the Apple LaserWriter NTX, which completed the test in 436 seconds, but it is more than 5 minutes faster than several other PostScript-compatible printers, among them the Apple LaserWriter NT, the Qume Scripten, and the IBM PagePrinter—impressive for such low-cost programs.

MORE TO IT THAN SPEED But speed alone doesn't constitute good performance. Earlier versions of *GoScript*, for instance, did not support all PostScript commands. Moreover, the Set Screen command, which is used to generate certain fill patterns, did nothing more than generate an interpreter error in an earlier version. The current version of *GoScript*, 2.03, which is shipping now, won't balk when it encounters this command. But instead of printing the correct diagonal pattern, it filled our test image with solid black. Moreover, when you select a pattern from a menu, you won't know whether or not it uses the Set Screen command. The *GoScript* manual should include a list of the fill patterns it does not support.

We didn't experience these problems with *Freedom of Press*. Besides being an almost bulletproof interpreter, *Freedom of Press* includes several enhanced features. Batch files make it easy to specify the default printer or to specify a substitute printer driver on the fly. *Freedom of Press* also has on-line help; it's really just an electronic crib sheet of the printers that the program supports, but it's helpful nonetheless.

Both *Freedom of Press* and *GoScript* allow you to modify the print command slightly, so that you can print more than one file at a time or print multiple copies of one file. *GoScript*'s enhancements aren't many, but one feature that does distinguish this product is its interactive mode. You can issue single PostScript commands that will be executed as you type them, which is great for beginning PostScript programmers.

RETROFITTING POSTSCRIPT More than anything else, *Freedom of Press* and *GoScript* offer easy and inexpensive upgrade paths for the printer you already own. By including Hewlett-Packard LaserJet and Epson drivers, these programs make it possible to bring PostScript compatibility to almost any printer on the market.

Both LaserGo and Custom Applications have promised color PostScript interpreters within the year. Couple that with the fact that both vendors supply drivers for the HP PaintJet and 24-pin dot matrix printers, and you have a $500-and-under alternative to the $25,000 QMS ColorScript Laser.

The best news about programs of this kind—and you can expect to see a few more on the market in the next few months—is that they prove that the PostScript language itself is robust enough to stand up to enhancements, clones, and kludges. All of which is necessary if PostScript is to become accessible to users at all levels of expertise, and with all kinds of equipment.—**Luisa Simone**

Luisa Simone is an executive editor of PC Magazine.

FACT FILE

PS-388 Accelerator
Princeton Publishing Labs Inc.
19 Wall St.
Princeton, NJ 08540
(609) 924-1153
List Price: $2,795
Requires: No RAM needed in host system; PC, XT, AT, PS/2 Model 30, or compatible; HP LaserJet Series II. Installable in network servers.
In Short: Blazingly fast, easy to install, and simple to operate, the PS-388 is worth every penny if you need to get the best performance out of your LaserJet Series II investment with PostScript applications. Aside from unfinished documentation, it seems to suffer from none of the shortcomings or difficulties of its competitors.

CIRCLE 420 ON READER SERVICE CARD

nary version with missing illustrations and other rough edges. A section described an Epson LQ emulation mode that does not exist. But these are small faults in light of the PS-388's performance and ease of use. In fact, after the first 20 minutes or so, you probably won't need to refer to the manual at all.

The PS-388 is the most expensive board tested here. Yet even at that higher price, it represents the best value. At $2,795, the board costs relatively little more than its competition, yet it offers dramatically increased performance. In short, this one is a winner.

QMS INC.
JetScript

QMS has long had a reputation in the field of PostScript. That company was the first to come in with a replacement controller for the original LaserJet and LaserJet Plus printers, which gave these machines PostScript capabilities through the electronic equivalent of a brain transplant. QMS has made headlines more recently with its line of color PostScript printers.

So it should hardly come as a surprise that QMS also has a PostScript adapter for the Series II. The $2,495 JetScript has a Motorola 68000 microprocessor with 3MB of RAM standard. One small distinction is that the processor runs at 16 MHz

The Diconix 150 printer. Completes The silent partner



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most any system. Quietly. that fits in a briefcase.

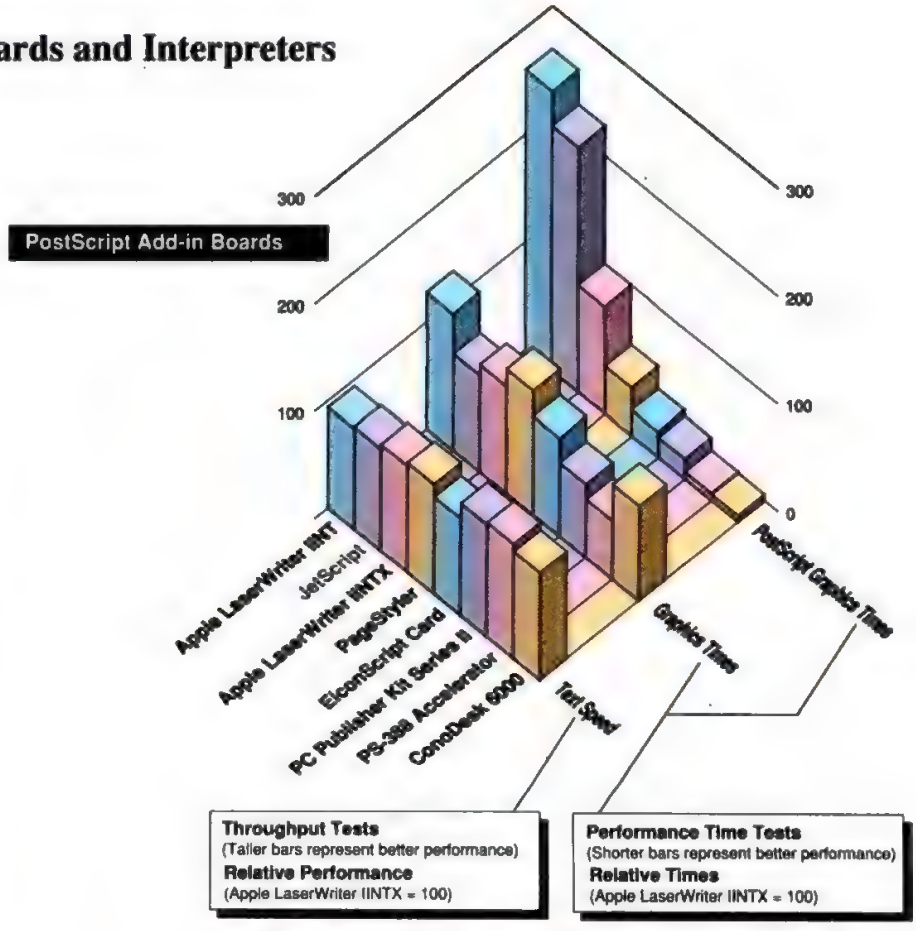


EASTMAN KODAK COMPANY
343 State Street
Rochester, New York 14650
1-800-DICONIX

CIRCLE 363 ON READER SERVICE CARD

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Benchmark Tests: PostScript Add-in Boards and Interpreters



Throughput Tests
(Results given in pages per minute)

Performance Time Tests
(Results given in seconds)

	Text Speed	Graphics Times	PostScript Graphics Times
Apple LaserWriter IINT	6.40	48.20	1,135.00
JetScript	6.50	33.96	996.00
Apple LaserWriter IINTX	6.80	37.93	436.00
PageStyler	7.03	44.14	196.80
EiconScript Card	6.21	35.06	103.50
PC Publisher Kit Series II	7.16	26.03	83.00
PS-388 Accelerator	7.26	21.05	30.43
ConoDesk 6000	6.79	33.67	24.51

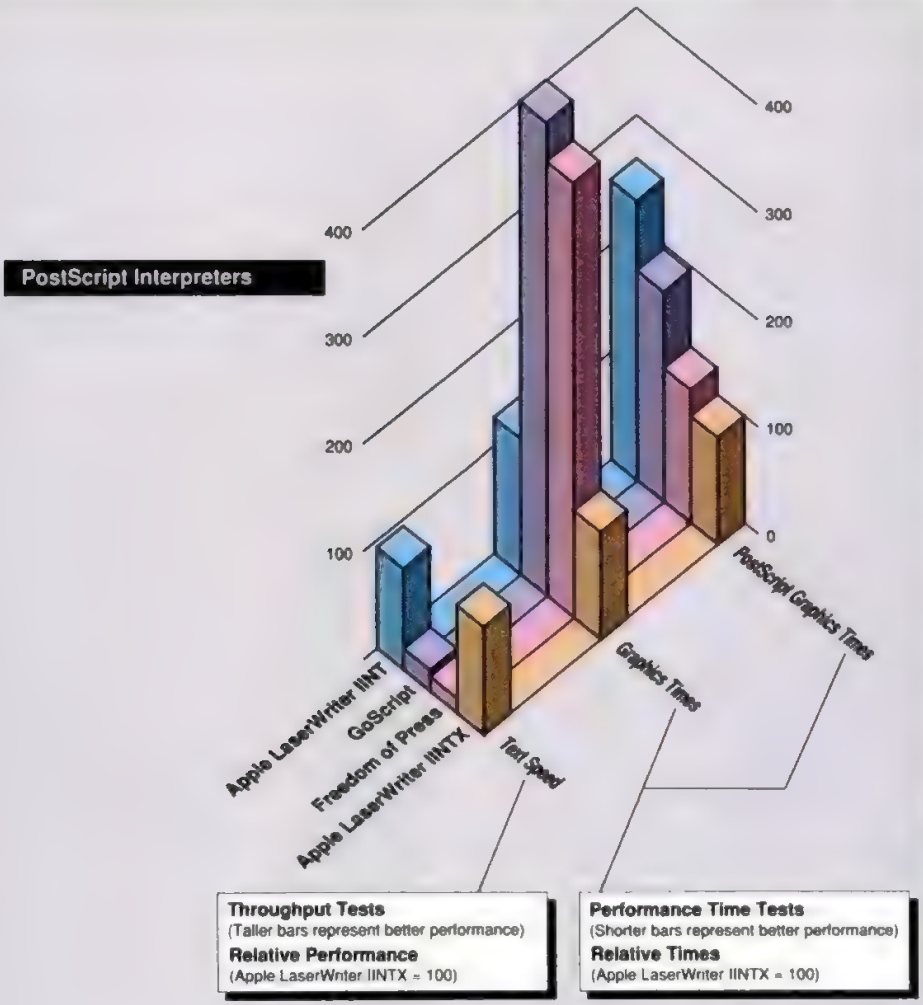
The big news in our roundup is that these PostScript boards are strong performers, outstripping the Apple LaserWriter IINT, the standard against which we compared them. Clearly, a strong factor in this outcome is the efficiency of the PostScript interpreter. Of the boards we tested, only QMS's JetScript uses a licensed copy of Adobe PostScript—which contributes to its slow times. The JetScript enhances the performance somewhat, however, by pushing its Motorola 68000 processor from 12 MHz to 16 MHz. If you insist on the real thing, the JetScript is a solid performer in this class.

The rest of the boards all use PostScript clone interpreters, and they shaved anywhere from 83 to 98 percent off the PostScript Graphics Times the LaserWriter IINT achieved. All of them even surpassed Apple's leading machine, the 68020-based LaserWriter IINTX.

Princeton Publishing's PS-388 Accelerator and Conographic's ConoDesk 6000, with their custom processor chips, were among the speediest boards tested. By contrast, the PC Publisher Kit Series II uses an ordinary 68000 processor chip but still chalks up an overall performance record surpassed only by the PS-388 Accelerator (which was the very fastest on text and standard graphics, and second-best on the PostScript graphics test). Remember, however, that if you use a board based on a PostScript clone, what you gain in speed you may lose in compatibility.

As for the software PostScript emulators (which we tested on an 8-MHz IBM AT): with text printing speeds of only about one page per minute, they are clearly not for everyone. They do somewhat better at graphics, outstripping the LaserWriter IINT on the PostScript graphics test, though lagging far behind it in the standard graphics test.

Freedom of Press was the more efficient of the two packages, beating *GoScript* on both graphics tests and—surprisingly—approaching the time achieved by the LaserWriter IINTX in the case of the PostScript test. If most of your PostScript work involves graphics, and if you can tolerate the inconvenience of writing your PostScript output to a file before printing, one of these two products may be a serviceable low-cost option.



Throughput Tests
(Results given in pages per minute)

Performance Time Tests
(Results given in seconds)

	Text Speed	Graphics Times	PostScript Graphics Times
Apple LaserWriter IINT	6.40	48.20	1,135.00
GoScript	1.35	167.16	854.95
Freedom of Press	0.92	153.47	543.00
Apple LaserWriter IINTX	6.80	37.93	436.00

The **Text Speed** test prints a two-page single-spaced business letter: one copy for dot matrix printers, ten copies for laser printers. Print speed is measured in characters per second for dot matrix printers and in pages per minute for laser printers. Because the test document simulates a typical business letter with lots of white space, the speeds achieved by dot matrix printers are almost always much slower than their manufacturers' rated speeds, which are based on printing a single full line of characters.

The **Graphics Times** test uses a file with lines, rectangles, circles, and several fill patterns, which is stored in an output file on-disk using *Microsoft Windows* and printed three times using the DOS COPY command. The reported result is the average time per page over the three trials, given in seconds. A separate set of tests is run for each standard emulation that the printer supports.

The **PostScript Graphics Times** test clocks the processing speed of PostScript printers. It uses two large characters as a clipping area and draws a series of Bezier splines. The time reported is the number of seconds it takes to print a page.

(however, the processor chip in our evaluation unit was rated at only 12 MHz). A large, 8-bit expansion board fits in the computer, with a typically small card for the printer, connected by a 37-pin cable. It can also be installed in a network file server. The installation program gives clear instructions on how to configure the board by setting two jumper blocks.

GENUINE POSTSCRIPT When it comes to soft drinks, everyone knows which one is the real thing. And when it comes to PostScript, the real thing is Adobe Systems. The big difference between the JetScript and its competitors is that it is the only one based on Adobe's PostScript. While none of the other systems based on "PostScript-compatible" interpreters made significant errors during our testing, some users will prefer to have the confidence and compatibility that come with using the genuine article.

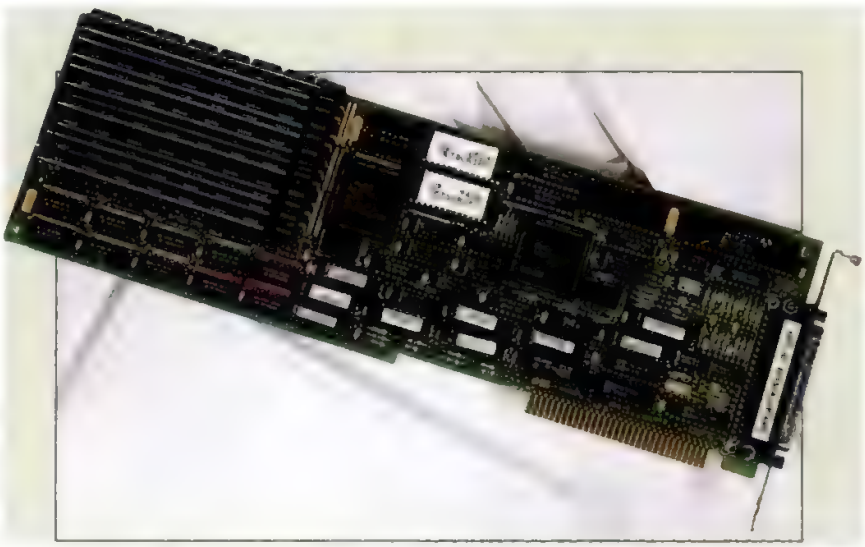
The JetScript takes over one of the computer's parallel port assignments: either LPT1, LPT2, or LPT3, so you can easily configure any PostScript application program to send its output to the designated port. The installation program makes the decision easier by polling these three devices to find a free port that it can use. (If all three ports are in use, the installation program halts with an error message.)

You can leave your LaserJet hooked up with the parallel or serial connection that

FACT FILE

JetScript
QMS Inc.
1 Magnum Pass
Mobile, AL 36618
(205) 633-4300
List Price: $2,495
Requires: 2MB RAM, HP LaserJet Series II printer. Installable in network servers.
In Short: The JetScript is the only add-in card reviewed here that offers the security of genuine Adobe PostScript, and it can be installed in a network server for shared use. But despite its 16-MHz processor, it is far back in the pack in terms of performance. Though easy to install and use, its faster competitors offer more for the money.

CIRCLE 421 ON READER SERVICE CARD



The Adobe PostScript version used by the $2,495 JetScript is significantly slower than the PostScript clones used by its competitors.

was in place before the JetScript was installed. Consequently, you can have access to both a PostScript and a LaserJet printer simply by using different DOS ports for printer output.

Once installed, JetScript is simple to use. Statements in your computer's CONFIG.SYS and AUTOEXEC.BAT files take care of initializing the card and loading PostScript into the board's memory at power-up. This takes only about a minute on an 8-MHz AT. The board's contents will survive a warm reboot, so you need do this only when you turn on the power to the computer at the beginning of the day.

Despite its faster CPU speed, the JetScript was one of the slower performers in our tests. Thus it will appeal primarily to those who want genuine Adobe PostScript in a trouble-free package. However, its list price is above the average for the six products, and those who are less picky about their PostScript's family background will find faster and less expensive alternatives to choose from among the clone products.

QMS INC.

PC Publisher Kit Series II

The second entry from QMS started life as the Imagen PC Publisher Kit. Since Imagen was purchased by QMS, however, the product has been marketed by The Laser Connection.

The $1,995 Publisher Kit Series II's notable distinction is its support for DDL, an alternate page-description language to PostScript. A number of desktop publishing programs can create DDL output, including *Ventura* and *PageMaker*.

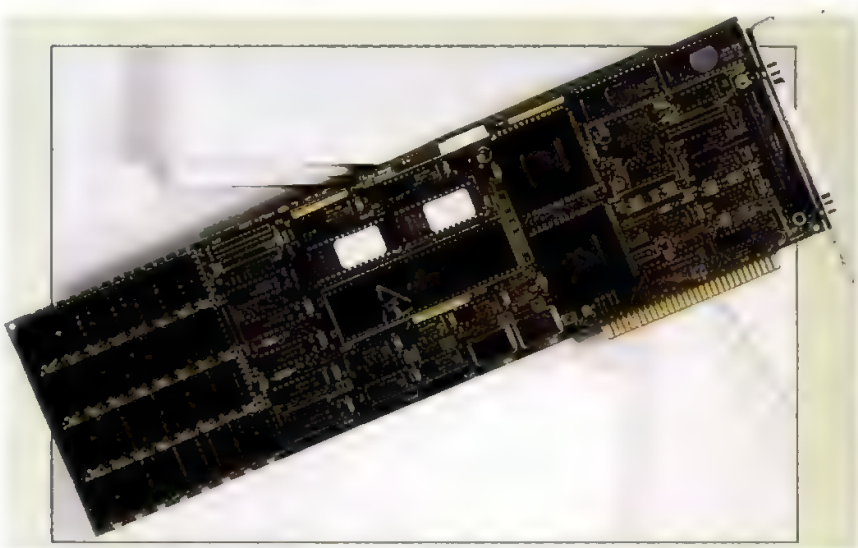
But the Publisher Kit also offers PostScript support through two different methods. The first allows you to print from PostScript commands that have been stored in a disk file. The second approach takes over a parallel port and directs the output through the Publisher Kit system. A simple command at the DOS prompt turns this feature on and off. In either case, you must initialize the Publisher Kit's processor board before you can use it to process PostScript commands.

The Publisher Kit comes with a variety of useful programs, including DDL Laser-

PC MAGAZINE FACT FILE

PC Publisher Kit Series II
QMS Inc.
1 Magnum Pass
Mobile, AL 36618
(205) 633-4300
List Price: $1,995
Requires: No RAM needed on host system; 2.8MB of free hard disk space; HP LaserJet Series II printer. Third-party software package required for installation in Novell network servers. Other networks not supported.
In Short: In the top half on performance and next to the bottom in price, the PC Publisher Kit Series II is flexible, easy to install, and very cost-effective.

CIRCLE 422 ON READER SERVICE CARD



The PC Publisher Kit Series II offers both PostScript and DDL support, as well as many other useful programs, at a low price of $1,995.

Publisher's Paintbrush™

The *art* of desktop publishing



This masthead was created using the fonts and typographic features of Publisher's Paintbrush.



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TOWARD A COMPETITION-GRADE LASERJET

Some people find that they do not need everything that PostScript offers. If all you want is more speed or flexibility from your LaserJet Series II, here are some options to consider.

These boards work by processing the regular LaserJet commands faster than the printer's controller. They offer scalable fonts through Bitstream *Fontware*, which creates LaserJet-compatible soft fonts in a wide variety of sizes and attributes from font outlines. These products also give you features beyond the functions of PCL (printer control language) and support high-speed output from desktop publishing programs through proprietary drivers.

In either case, although you won't be able to print from the same PostScript files as your large typesetting machine, you should be able to print desktop publishing or presentation graphics pages much faster than with an unmodified LaserJet.

TALL TREE SYSTEMS

JLaser Plus AT4

The JLaser Plus AT4 from Tall Tree Systems consists of the JRam memory expansion card that fits inside the computer and a small JLaser daughtercard that rides on top. This assembly connects by means of a 25-pin cable to the JSX adapter card that fits into the expansion slot of the LaserJet Series II.

You can use the versatile JLaser in a number of ways. It can be addressed as a standard LaserJet using the standard PCL commands. The system also comes with drivers for *Windows* and *Ventura Publisher*, so that you can use it to get high-speed output from these desktop publishing programs.

As it comes in the JLaser package, *Fontware* includes the Bitstream outlines for the Courier, Times Roman, and Helvetica type-style families, plus a symbol typeface. This selection gives you the same set of 13 type-style options that make up the basic PostScript complement. As a plus, you also get Bitstream Charter, an attractive font designed specifically for laser printers.

The package comes with a number of other useful programs and utilities, including JBanner, which uses the Bitstream font outlines to create text pages on the fly, without having to create the full font first and store it on-disk. As the name implies, it can be used to create banners, signs, or presentation text charts. The system can also generate display fonts, so that your screen will match what's on the printed page.

ENHANCED GRAPHICS The JLaser system adds some new capabilities to your LaserJet printer, most notably an enhanced graphics mode that allows printing at a resolution of 300 by 600 dots per inch in addition to the standard 300 by 300 dpi. At present, this feature is supported only by a few graphics programs, but Tall Tree Systems is developing drivers for desktop publishing programs so that they can take advantage of the extra resolution.

The JLaser system is fairly easy to install and run, thanks to its installation batch files. You may find that the installation process gets somewhat more difficult, however, if you depart from the default settings. The documentation is acceptable but nothing to crow about. It is spread over four separate booklets, and the information you need can be difficult to find.

If what you need is speed and scalable font outlines and you use your LaserJet printer primarily for desktop publishing, then the JLaser Plus cards offer a good low-cost alternative to a PostScript add-in card.

LASERMASTER CORP.

LaserMaster LC2 CAPCard Controller

The LaserMaster CAPCard is best suited for one purpose: producing desktop publishing pages quickly from LaserJet printers. Originally designed for use with *Ventura Publisher*, it now has a driver for *Windows* so that you can use it with *PageMaker* as well.

The CAPCard system consists of an

FACT FILE

JLaser Plus AT4



Tall Tree Systems
2585 East Bayshore Rd.
Palo Alto, CA 94303
(415) 493-1980
List Price: Model AT2, $699; Model AT4, $749; JSX adapter and cable (required), $140.
Requires: 1MB RAM, HP LaserJet Series II printer.
In Short: The JLaser kit is a low-cost speed-up for your LaserJet Series II. It uses the PCL command language and also supports *Windows* and *Ventura* through special drivers. The system comes with the Bitstream *Fontware* programs and 14 font outlines for the Courier, Times Roman, and Helvetica type-style familes, which add significantly to the overall value of the package.
CIRCLE **428** ON READER SERVICE CARD

LaserMaster LC2 CAPCard Controller



LaserMaster Corp.
7156 Shady Oak Rd.
Eden Prairie, MN 55344
(612) 944-6069
List Price: Standard version (without scaling fonts), $1,490; enhanced version (with 13 fonts), $1,980; enhanced version plus (with 35 fonts), $2,285.
Requires: 640K RAM (to run most applications), 6.5MB hard disk space for precached fonts; Brother HL-8, Canon LBP-8ii, or HP LaserJet Series II printer.
In Short: The LaserMaster CAPCard costs about as much as the PostScript boards but takes a different course. It creates fonts on the fly and performs quickly, but uses custom drivers and an extended PCL command set to communicate with applications.
CIRCLE **429** ON READER SERVICE CARD

8-bit expansion card for your computer, plus an option card for your LaserJet Series II printer. Unlike any other board set tested in this review, the CAPCard uses a simple cable with modular phone plugs for the connection. It seems hard to understand how so much data flies through those few wires, but it works all the same.

SOFT FONTS ON THE FLY Like the JLaser, the CAPCard relies on Bitstream outline fonts, and it comes with either 13 or 35 font outlines, depending on the version you purchase. With most Bitstream products, you must use the *Fontware* program to generate soft fonts, which are stored on the disk and then downloaded to your printer each time you start it up. That's not the case here; the CAPCard creates the fonts on the fly, so you don't need to use up great portions of disk space for font files. As an added benefit, the font outlines use the same character-width tables as do Adobe PostScript fonts, so your final output should look more like PostScript pages.

Installation and setup are fairly quick and straightforward. The manual is well written, and there are installation batch files that help you get all the programs copied to your hard disk so that the card can find them. You'll find that handy utilities make it easy to use the system once it is installed.

The CAPCard can accept output from any application that sends out LaserJet commands, and it handled the PC Labs printer tests without a problem. More likely than not, however, you will buy this card to use with its own *Ventura* or *PageMaker* drivers for the faster output performance it offers.

You may hesitate to spend as much for the CAPCard as for a PostScript board, and if you need to send output to a typesetter regularly, the latter will definitely be more useful. But if you produce all your pages on your LaserJet, the CAPCard is worth your consideration.—**Alfred Poor**

PC EDITOR'S CHOICE

- **PS-388 Accelerator**

The six PostScript add-in boards reviewed here offer a performance advantage over standalone PostScript printers. But is that enough to make the HP LaserJet/add-in board combination a better buy than a standalone PostScript printer?

If you pay list price for an HP LaserJet and one of the add-in boards that were among the performance leaders in our benchmark tests, you'll spend more than $5,000. That's more than the cost of some PostScript printers, notably our Editor's Choice from our last roundup of printers, the Apple LaserWriter IINT. In fact, you may have to pay list price for these boards, since they do not yet command a demand sufficient to bear a widespread discount.

Aside from price, two other considerations are worth noting. Many PostScript printers now offer LaserJet emulation through the PostScript controller, which means you have access to scalable fonts through LaserJet commands. This is not the case with add-in boards, which generally rely on the LaserJet controller for the HP command set.

Still, no standalone printer comes close to the performance of the best boards in the group, so if raw speed is your primary concern, an add-in board is the best buy. The clear winner here is Princeton Publishing Labs' PS-388 Accelerator. It costs a bit more than the others but its performance puts it so far out in front that it's worth the money. Moreover, a major factor in its high price is the fact that it comes with 500K to 1MB more RAM than every other system except one.

The Weitek RISC processor plays a big role in the PS-388's speed, bringing to it a level of performance that has until now been confined to the world of high-tech engineering workstations. The PS-388 is more than just fast, however. It is one of the easiest of the bunch to install and operate, no matter what application you are using to drive it.

We must point out, however, that if you're looking for complete compatibility with Adobe PostScript, you won't find it in the PS-388 or any other add-in board that uses a PostScript clone. In most cases, cutting corners on compatibility is the price that must be paid for speed. If 100 percent Adobe PostScript compatibility is your highest priority, you will be best off considering the $2,495 QMS JetScript, which is the only board tested that uses the real thing rather than a clone.

Honorable mention is due the PC Publisher Kit Series II from QMS Inc. It is in the top half of the pack in terms of performance, yet manages to offer the next-to-lowest list price of all. This one is the bargain hunter's selection.

Control, a specialized version of the LaserControl setup and emulation program for page printers. The DDL LaserControl program allows your laser printer to emulate various popular line printers by converting their commands into DDL on the fly and then printing the DDL output. This handy feature makes it possible for you to use the PC Publisher Kit with programs that do not support the LaserJet or PostScript—for example, by emulating an Epson dot matrix printer.

SIMPLE BUT FAST The PC Publisher Kit has an 8-bit expansion card with a 68000 processor and 2MB of memory, a

small card for the printer, and a 37-pin cable. Installation is a snap because there are no settings to contend with on any of the boards; everything is handled through the installation software. The manual shows all the steps clearly and includes screen shots showing the lists of filenames that will appear as the software is copied onto your hard disk.

The unit turned in some impressive performance times, especially when you consider it has the second-lowest list price of the group. But we did run into two problems while testing this as a PostScript printer; both occurred while printing from files of PostScript commands. In one case where the PostScript Executive command came at the top of the file, the Publisher Kit's software and DOS fought over access to the disk, slowing performance to a crawl; however, this problem is unlikely to arise in most applications. The system also refused to print a file that ended with the DOS end-of-file character (Ctrl-Z), which might give you trouble if you create or edit PostScript files with a word processor instead of generating them directly from your applications.

■ The PC Publisher Kit turned in some impressive performance times, especially when you consider it has the second-lowest list price of the group.

Overall, the PC Publisher Kit represents an attractive value. With support of DDL, it is suitable for desktop publishing applications. Possibly the best choice if you want to get the best performance for the least money, it is well worth a look. PC

Alfred Poor is a consultant and analyst in Perkasie, Pennsylvania, and a frequent contributor to PC Magazine.



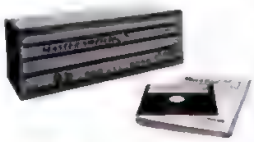
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Greg Herrick, President
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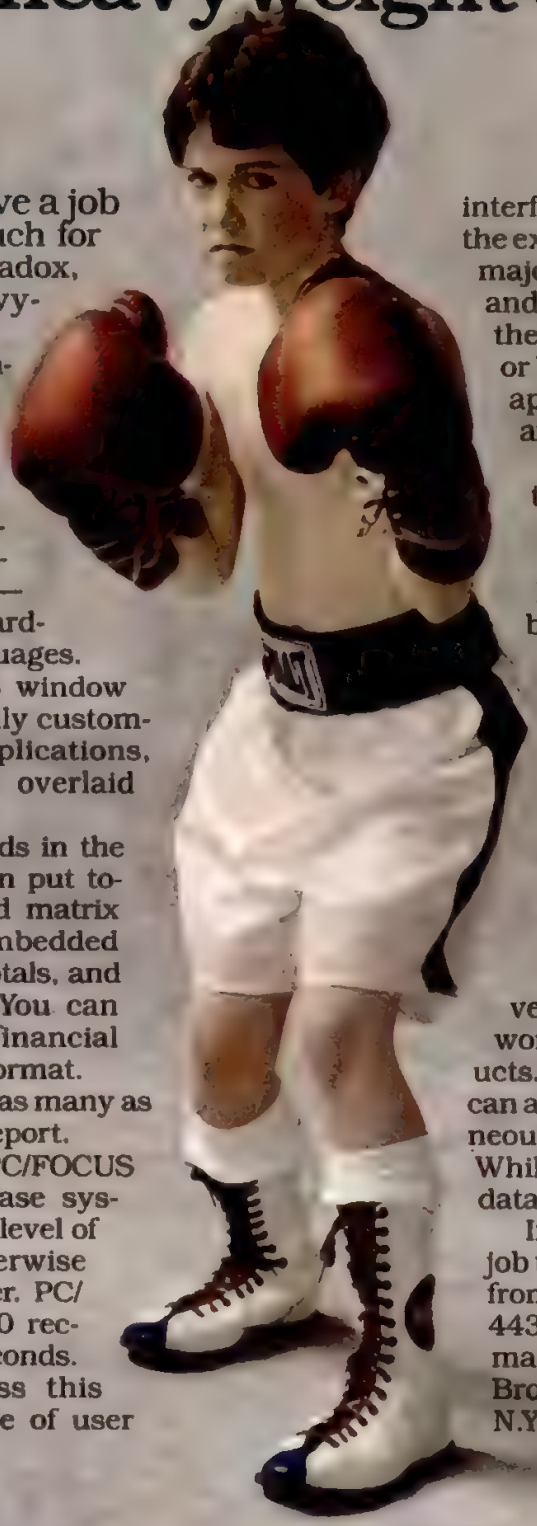
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■ PC LAB NOTES ■ GUS VENDITTO

THE ATTRACTION OF PC MAGNET

If you haven't joined the thousands of readers who have already been drawn to PC MagNet, you're missing more than an easy way to download our utilities. Here's a glimpse inside.

When we launched our on-line service, PC MagNet, last year, *PC Magazine* was breaking new ground in publishing history. Aside from fancy graphics techniques and improved photo quality, today's magazines are essentially the same mixture of pictures and stories that appeared a century ago. And while on-line services have been growing slowly in recent years, PC MagNet represents the first time that a publication has put itself within a local phone call's reach of virtually every reader.

Any reader can call PC MagNet at any hour of the day or night to download programs and batch files, to participate in surveys on current PC issues, to ask questions about an article, to talk back to the magazine's writers and editors, and to communicate with thousands of our readers. *PC Magazine* has become a two-way street, a forum rather than a pulpit.

THE COMPUSERVE CONNECTION PC MagNet's structure is diagrammed in the sidebar "A Guide to PC MagNet." It will be familiar to anyone who's spent time on CompuServe, since it's run through the same dial-in network, which has access phone numbers in nearly every area code in the U.S. and Canada. See the sidebar "Connecting to PC MagNet" for a list of telephone numbers. If you haven't yet signed up, the sidebar "How to Join PC MagNet" will show you how.

You can either call into PC MagNet directly or, if you're already logged onto CompuServe, you can switch over to PC MagNet at any prompt simply by typing GO PCMAGNET. When you do, CompuServe passes you over to the PC MagNet VAX that manages our separate operation within the overall CompuServe structure. Our part of the system can accept up to 400 callers at a time. CompuServe bills callers by the minute, at a rate of $12.50 an hour.

PC MagNet adds several elements to the basic CompuServe SIG (Special Interest Group) structure. To make it easy for callers to dial in and quickly find and download any of our more than 1,000 files, we've set up a Utilities Database. It includes a search engine to help you find files by name, type, issue number, or the department where they appeared in the magazine. You can then download them using XMODEM or one of CompuServe's two error-checking protocols. (For more information on these, see the sidebar "Choosing a Download Protocol.")

A STOREHOUSE OF PROGRAMS If you've only recently discovered *PC Magazine* utilities, you may be surprised at the programs published in years past. The Utilities Database covers programs published as far back as early 1985.

But there's a lot more available for downloading than the utilities we publish in each issue. There are the benchmark programs used in preparing our reviews; there are the batch files and short programs from User-to-User, PC Tutor, Power Programming, and all of the other Productivity columns; there are shareware and public-domain programs that we've reviewed; and there are indexes, in either *dBASE*, ASCII, or comma-delimited form, that list every product reviewed in the magazine, year by year, since 1985.

Since that's a lot to wade through and the essence of intelligent CompuServe use is to minimize on-line time, we've also in-

PRODUCTIVITY INDEX

PC LAB NOTES
An explanation of *PC Magazine*'s on-line service, PC MagNet.
UTILITIES
LASERLST, a utility that puts two full text pages on a single sheet.
ENVIRONMENTS
Add your own moving logic to the TIMELINE program.
POWER PROGRAMMING
The kinds of indexed files and file index structures are explored.
SPREADSHEET CLINIC
Calculate time in *SuperCalc; Excel* modifies certain value entries.
USER-TO-USER
Build a hard disk menu system; track bootups with a DOS bug.
POWER USER
Create your own pop-up menus with *WordPerfect* 5.0's macro commands.
LANGUAGES
Turbo Pascal's word-align function; a fast way to search text in BASIC.
PC TUTOR
Examine large files with DEBUG; interpreting PCMAP's output.
CONNECTIVITY CLINIC
Combine operating systems easily; replace a minicomputer with a LAN.

■ PC LAB NOTES

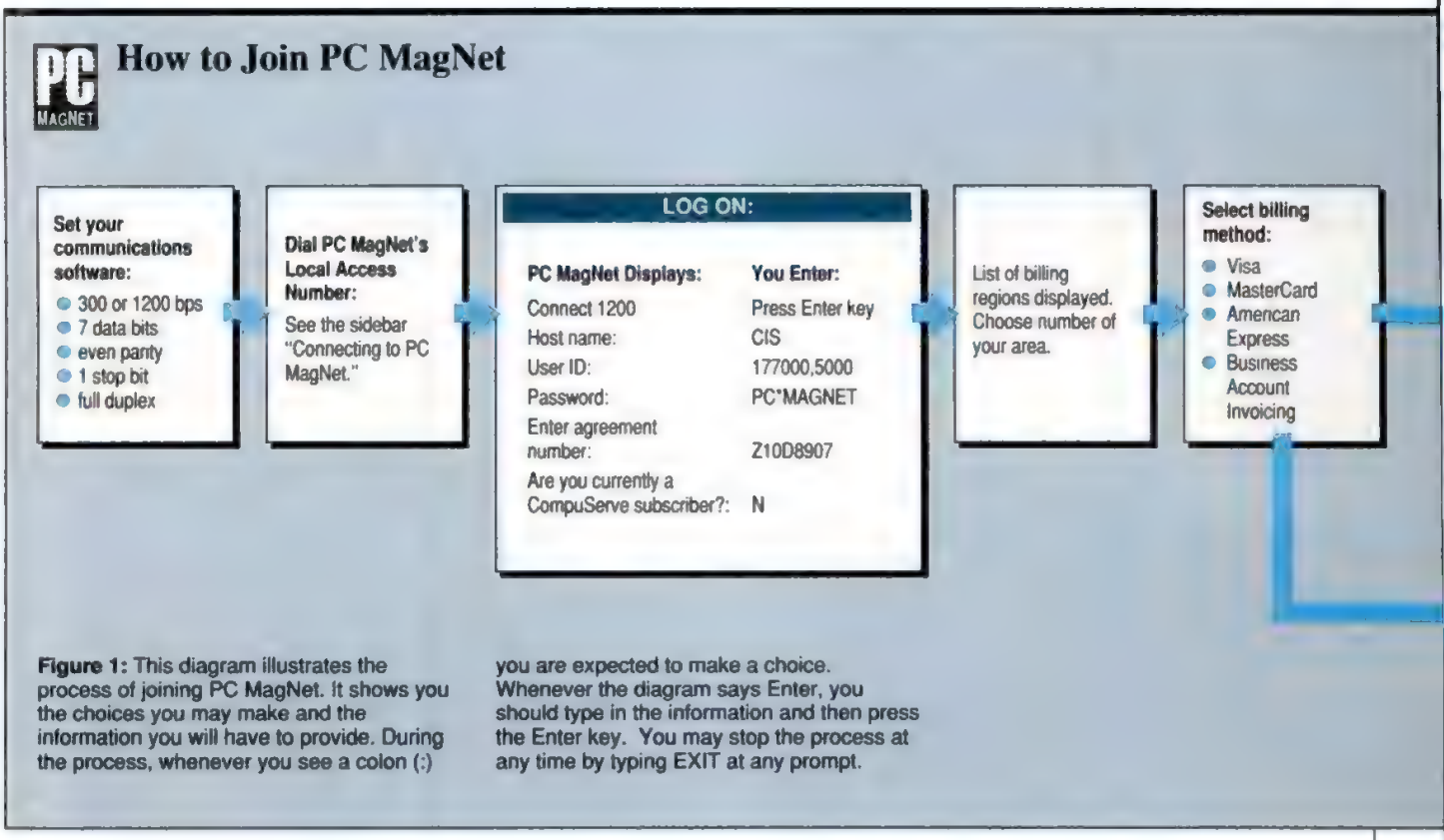


Figure 1: This diagram illustrates the process of joining PC MagNet. It shows you the choices you may make and the information you will have to provide. During the process, whenever you see a colon (:) you are expected to make a choice. Whenever the diagram says Enter, you should type in the information and then press the Enter key. You may stop the process at any time by typing EXIT at any prompt.

cluded a Utilities Index that you can download and search through off-line. To save still more on connect charges, many of the files are stored in an archived (ARCed) format that cuts file size by anywhere from 10 to 30 percent, depending on the type of file. PC MagNet files that carry the .ARC extension must, of course, be unpacked before they can be used. For this, you'll need the program PK361.EXE. The PK stands for the programmer, Phil Katz, and the number reflects the current version; don't be concerned if the PK file posted has a higher number when you get ready to download it. The unpacking utility is stored in the Shareware section of the Utilities Database. Once you've downloaded it and extracted the files by typing PK361, un-ARC files by entering

```
PKUNPAK filename
```

THE PERSONAL TOUCH As I indicated, however, PC MagNet is far more than a clearing house for programs and article indexes. It was designed to bring *PC Magazine*'s readers and editors closer together.

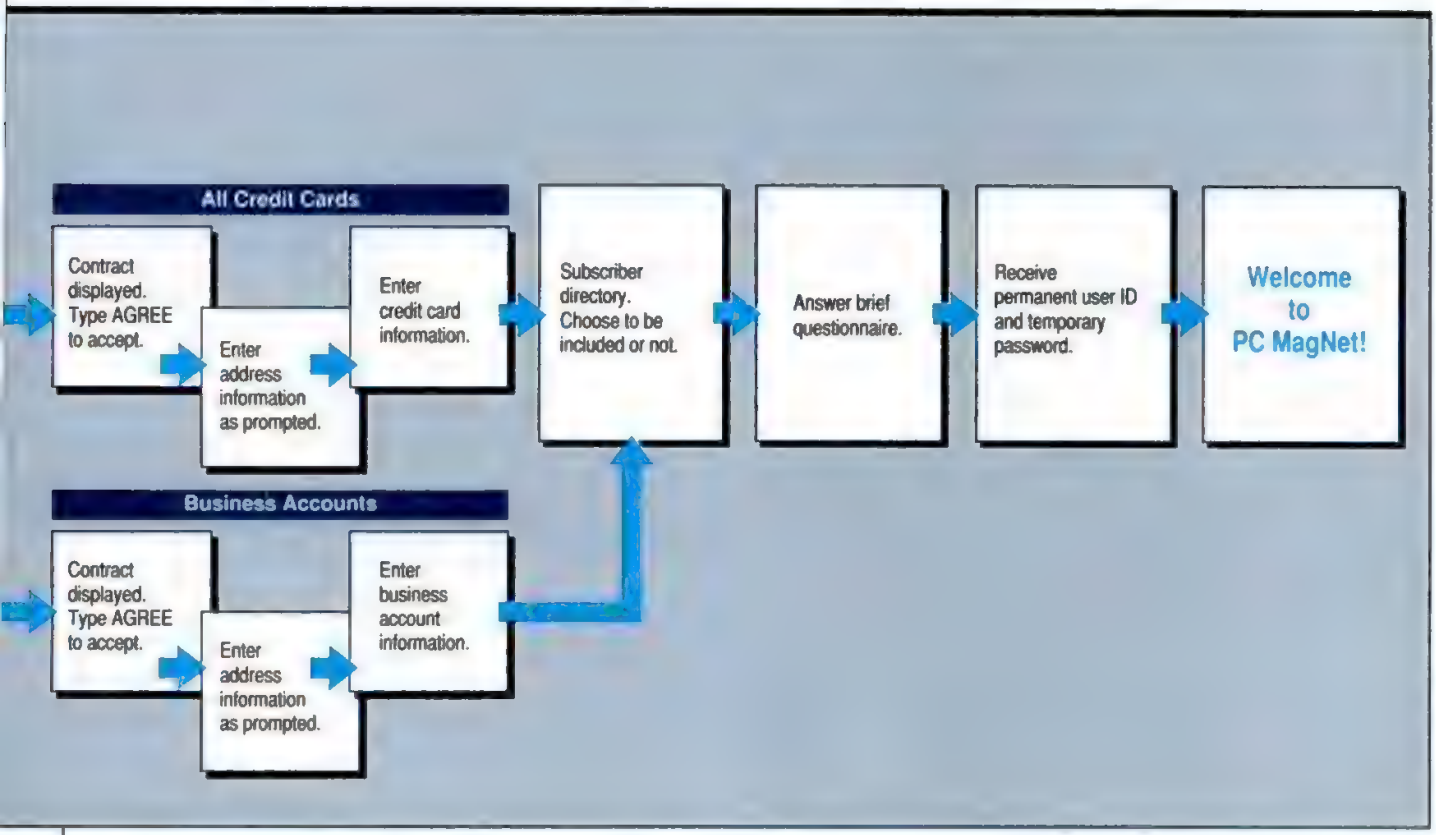
Much of the magazine's success has stemmed from the editors' careful attention to comments from readers. When tips submitted to User-to-User reflected a growing interest in LANs, Connectivity Clinic was born. If many readers ask questions about using a particular kind of software or hardware, we create a PC Lab Notes that delves into the topic. And when readers respond favorably to any kind of product coverage, we start to plan more.

■ PC MagNet isn't just a clearing house for programs. It brings *PC Magazine* readers and editors closer together.

PC MagNet accelerates this process. It cuts out the middlemen of hard copy and postage. Indeed, a large proportion of the Letters to *PC Magazine* we publish have been received via PC MagNet.

Beyond mere comment, however, readers are taking advantage of our forums to engage editors and writers in dialogue. If John Dvorak should happen to rub a reader the wrong way, Dvorak will be up on MagNet in the Editorial Forum to take the abuse and elaborate on his point. Will Zachmann often conducts public surveys to get a feel for what people are interested in hearing about before he writes his column. And all of the discussion is posted for everyone to see.

Responding to questions, Bill Machrone and other editors have spelled out the reasoning behind our coverage of particular stories. Sometimes, a caller merely wants to clear up a point he found confusing. Or, a number of readers may feel a product has gotten a raw deal. In every case, the issue gets a public airing, with every caller free to contribute his own view. But, when it seems more appropriate, private messages can be posted as well.



The Editorial Forum has evolved into a freewheeling, no-holds-barred session that often goes far beyond topics raised in the magazine. There's even a public tavern of the airwaves here, called The Spike!, for hopelessly irreverent conversations.

Our other forums, Tips and Techniques, Utilforum, and Programming, stick more closely to business. Callers raise dozens of questions in these forums every day. If a question has a simple answer, you're likely to get it rather quickly. But you're also likely to get additional advice that addresses your problem in ways you never considered. If there's an incompatibility between the latest utility and some popular program, the solution will be posted in Utilforum as soon as someone discovers it.

FINDING YOUR WAY AROUND To get the most out of the forums, you'll need to learn a few navigation commands. The accompanying sidebar "Navigating PC MagNet" explains some of the basics. When you join PC MagNet, a packet of detailed manuals is mailed to you within a few weeks. As many of us have found, the easiest way to stay on top of the forum discussions is to acquire and use a copy of *Tapcis*, a shareware program that automates message retrieval and posting. *Tapcis* is available in the Utilities Database under Shareware.

■ The Editorial Forum has evolved into a no-holds-barred session that often goes beyond topics raised in the magazine.

To make sense out of the hundreds of messages that get posted in each forum, PC MagNet categorizes them in two ways. The first is by section, which always reflects a particular department in *PC Magazine*. The Editorial Forum has the largest number of sections, covering First Looks, Features, After Hours, and the individual columnists.

Within sections, messages are broken down into various "threads," or subjects. Any caller who composes a new message has two choices: a subject and a recipient. An illustration will help clarify the point.

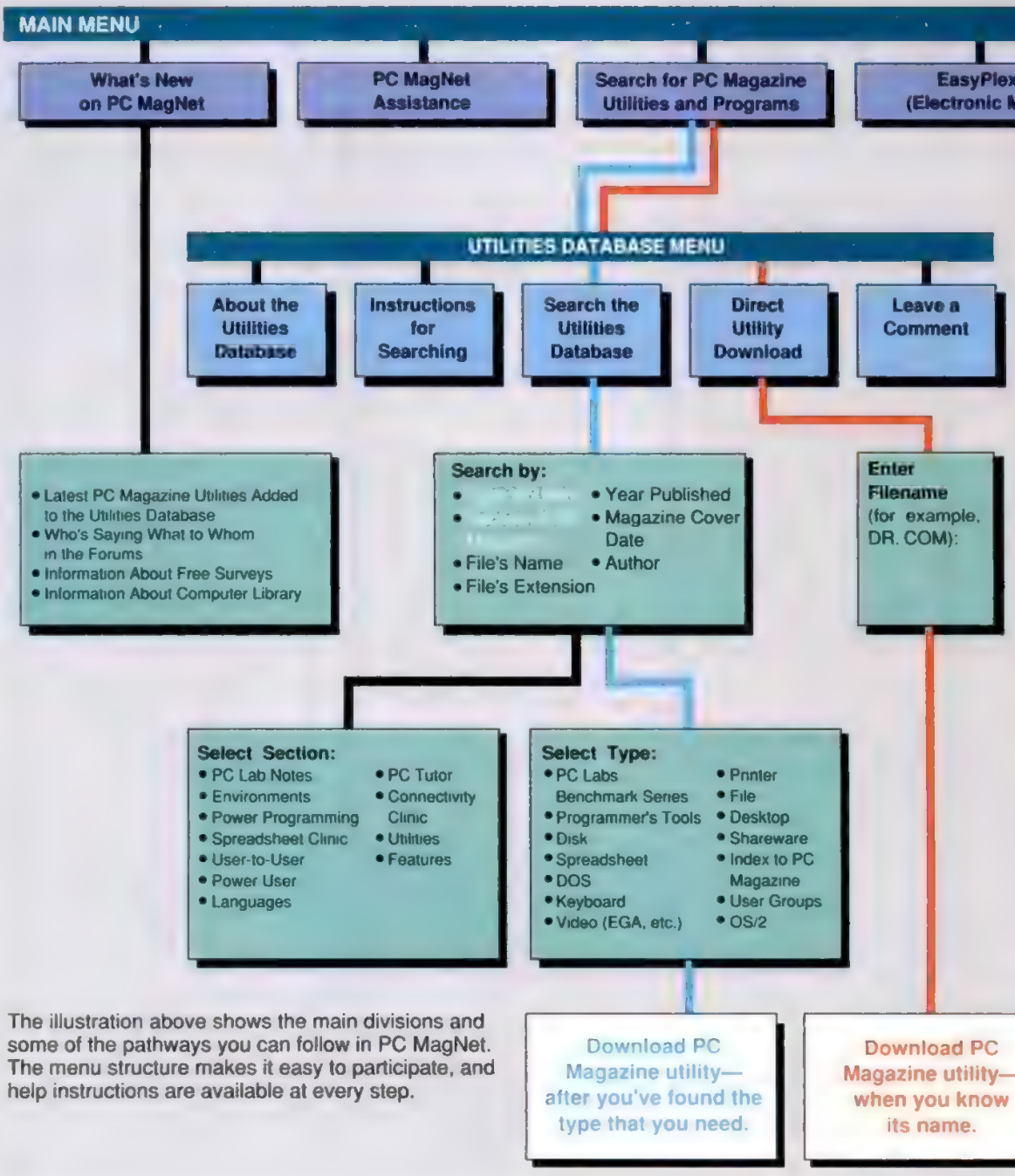
A typical thread might begin with a reader asking Bill Machrone what impact Intel's 486 chip will have on PC owners. When prompted by PC MagNet for a subject, the questioner might enter something like "Whither the 486?" His question, with this thread title, would then be posted in the Viewpoints-Machrone section in the Editorial Forum. Within a day or two, Bill Machrone would answer, but in the meantime so might many other PC MagNet members, *PC Magazine* editors, and PC industry professionals. Everyone can get into the act, responding either to the original message or to a subsequent response.

When you come on-line you can see the subject of the thread and the number of responses it has generated in the forum's message directory. You can access this di-

■ PC LAB NOTES

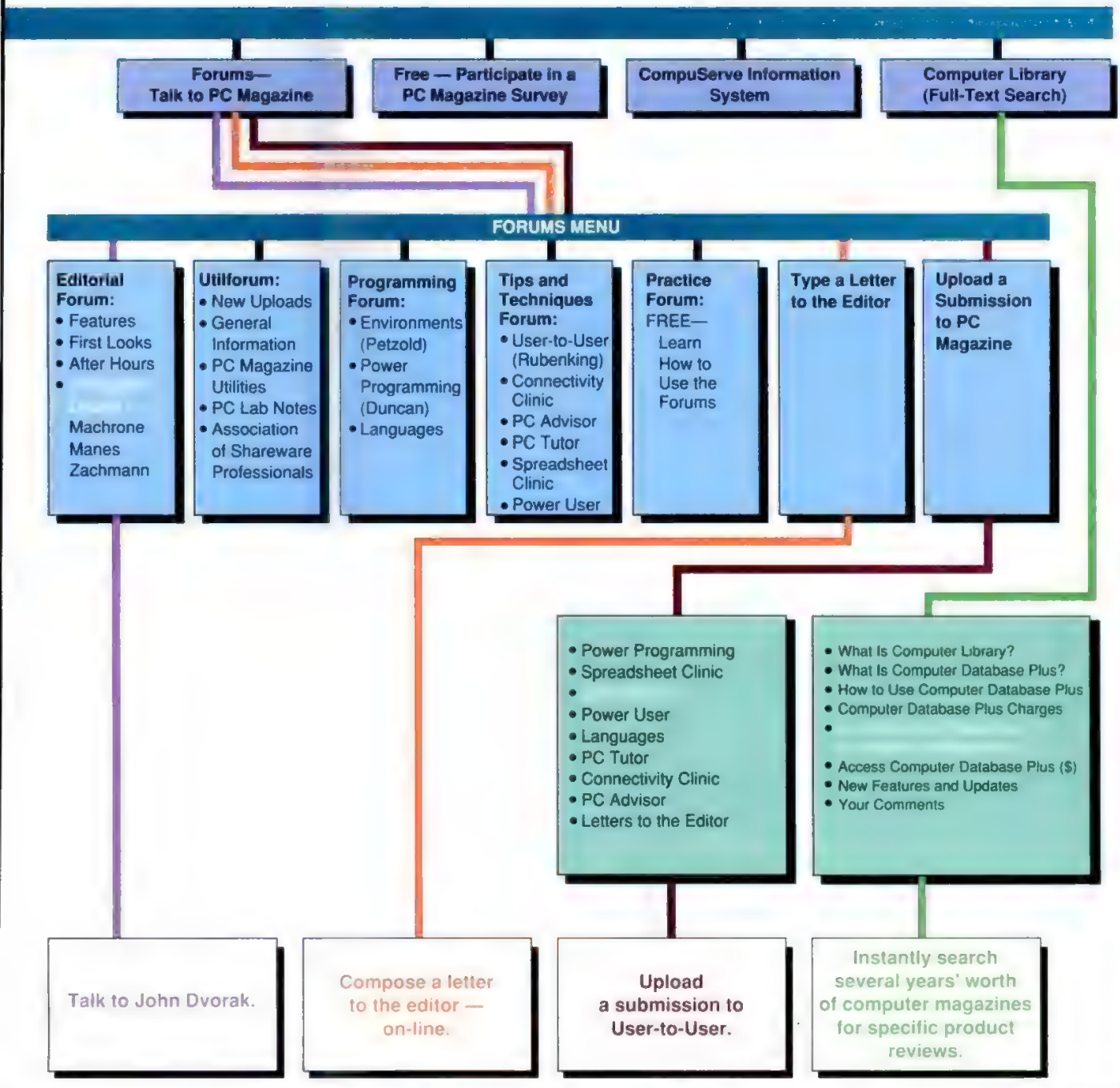
A Guide to PC MagNet

Where to find *PC Magazine* utilities, data files, and discussion forums



The illustration above shows the main divisions and some of the pathways you can follow in PC MagNet. The menu structure makes it easy to participate, and help instructions are available at every step.

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Forums—
Talk to PC Magazine
Free — Participate in a
PC Magazine Survey
CompuServe Information
System
Computer Library
(Full-Text Search)
FORUMS MENU
Editorial
Forum:
• Features
• First Looks
• After Hours
•
Machrone
Manes
Zachmann
Utilforum:
• New Uploads
• General
Information
• PC Magazine
Utilities
• PC Lab Notes
• Association
of Shareware
Professionals
Programming
Forum:
• Environments
(Petzold)
• Power
Programming
(Duncan)
• Languages
Tips and
Techniques
Forum:
• User-to-User
(Rubenking)
• Connectivity
Clinic
• PC Advisor
• PC Tutor
• Spreadsheet
Clinic
• Power User
Practice
Forum:
FREE—
Learn
How to
Use the
Forums
Type a Letter
to the Editor
Upload a
Submission
to PC
Magazine
• Power Programming
• Spreadsheet Clinic
•
• Power User
• Languages
• PC Tutor
• Connectivity Clinic
• PC Advisor
• Letters to the Editor
• What Is Computer Library?
• What Is Computer Database Plus?
• How to Use Computer Database Plus
• Computer Database Plus Charges
•
• Access Computer Database Plus ($)
• New Features and Updates
• Your Comments
Talk to John Dvorak.
Compose a letter
to the editor —
on-line.
Upload
a submission to
User-to-User.
Instantly search
several years' worth
of computer magazines
for specific product
reviews.



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CIRCLE 182 ON READER SERVICE CARD

■ PC LAB NOTES

Connecting to PC MagNet

Here, sorted by area code, is a partial directory of PC MagNet's local access numbers for 300- and 1,200-bit-per-second modems. Any of these numbers will connect you to the CompuServe network. Set your modem for 7 data bits, even parity, 1 stop bit, and full duplex.

If you don't find a number in your dialing exchange here, or if you want to find a number that supports 2,400-bps operation, start by using the number for the exchange nearest you. Then, once connected to PC MagNet, type GO PHONES to see a complete listing.

PC MagNet can be accessed through alternative communication networks including Telenet, TYMNET, DataPac, Computer Sciences Corp., and LATA Networks. All networks charge a usage premium (CompuServe's is $.30 per hour), and rates and local access numbers for alternative networks are available on-line.

—Christopher Barr

CITY	ST	AC	NUMBER
Parsippany	NJ	(201)	267-0085
Hackensack	NJ	(201)	[illegible]
Ridgewood	NJ	(201)	444-3913
Jersey City	NJ	(201)	624-6565
Wayne	NJ	(201)	633-5030
Montclair	NJ	(201)	783-5400
Washington	DC	(202)	[illegible]
Fairfield	CT	(203)	222-1748
New Haven	CT	(203)	467-3489
North Haven	CT	(203)	467-3489
Hartford	CT	(203)	728-0633
Danbury	CT	(203)	797-1815
Bridgeport	CT	(203)	926-0001
Montgomery	AL	(205)	262-0010
Mobile	AL	(205)	[illegible]
Tuscaloosa	AL	(205)	553-1120
Birmingham	AL	(205)	879-2250
Seattle	WA	(206)	241-9111
Everett	WA	(206)	252-4414
Olympia	WA	(206)	[illegible]
Tacoma	WA	(206)	922-1790
Portland	ME	(207)	879-0005
Pocatello	ID	(208)	232-9452
Boise	ID	(208)	[illegible]
Fresno	CA	(209)	252-1892
Stockton	CA	(209)	465-7251
Modesto	CA	(209)	521-9970
New York	NY	(212)	758-2090
Culver City	CA	(213)	390-9617
Long Beach	CA	(213)	591-8392
Los Angeles	CA	(213)	[illegible]
Dallas	TX	(214)	953-1971
Reading	PA	(215)	375-4850
Allentown	PA	(215)	776-6960
Philadelphia	PA	(215)	977-9758
Canton	OH	(216)	455-2516
Youngstown	OH	(216)	743-4992
Cleveland	OH	(216)	781-5720
Akron	OH	(216)	867-1237
Champaign	IL	(217)	352-0041
Springfield	IL	(217)	789-0944
South Bend	IN	(219)	271-9541
Ft. Wayne	IN	(219)	447-0510
Gary	IN	(219)	980-1333
Annapolis	MD	(301)	266-7530
Salisbury	MD	(301)	548-1502
Hyattsville	MD	(301)	[illegible]
Baltimore	MD	(301)	832-0100
Newark	DE	(302)	731-2940
Grand Junction	CO	(303)	241-1885
Durango	CO	(303)	[illegible]
Denver	CO	(303)	[illegible]
Dillon	CO	(303)	[illegible]
Steamboat Spng	CO	(303)	[illegible]
Aspen	CO	(303)	925-5892
Glenwood Spring	CO	(303)	945-0351
Vail	CO	(303)	[illegible]
Wheeling	WV	(304)	233-9470
Huntington	WV	(304)	733-4010
Charleston	WV	(304)	768-9700
Miami	FL	(305)	266-0231
Ft. Lauderdale	FL	(305)	772-3240
Cheyenne	WY	(307)	637-3027
Jackson	WY	(307)	733-1640
Laramie	WY	(307)	742-9641
Peoria	IL	(309)	[illegible]
Bloomington	IL	(309)	827-3343
Chicago	IL	(312)	[illegible]
Aurora	IL	(312)	859-1557
Flint	MI	(313)	238-6202
Detroit	MI	(313)	255-9207
Pontiac	MI	(313)	[illegible]
Mt Clemens	MI	(313)	[illegible]
Ann Arbor	MI	(313)	[illegible]
St Louis	MO	(314)	241-3102
Columbia	MO	(314)	442-4600
Jefferson City	MO	(314)	635-9170
Syracuse	NY	(315)	458-6016
Wichita	KS	(316)	[illegible]
Muncie	IN	(317)	284-3812
Lafayette	IN	(317)	448-1357
Indianapolis	IN	(317)	638-2762
Monroe	LA	(318)	361-0700
Shreveport	LA	(318)	424-5380
Lake Charles	LA	(318)	433-0215
Davenport	IA	(319)	323-7388
Cedar Rapids	IA	(319)	365-9363
Providence	RI	(401)	[illegible]
Lincoln	NE	(402)	474-1006
Omaha	NE	(402)	[illegible]
Atlanta	GA	(404)	266-7014
Athens	GA	(404)	[illegible]
Columbus	GA	(404)	[illegible]
Augusta	GA	(404)	736-8750
Oklahoma City	OK	(405)	[illegible]
Billings	MT	(406)	245-0863
Helena	MT	(406)	[illegible]
West Palm Beach	FL	(407)	684-9051
Melbourne	FL	(407)	724-0857
Vero Beach	FL	(407)	778-0550
Orlando	FL	(407)	[illegible]
Monterey	CA	(408)	375-9931
Santa Cruz	CA	(408)	476-0422
San Jose	CA	(408)	[illegible]
Galveston	TX	(409)	763-5125
Butler	PA	(412)	285-8187
Pittsburgh	PA	(412)	391-8818
Amherst	MA	(413)	549-7431
Springfield	MA	(413)	734-7362
Milwaukee	WI	(414)	258 5616
Green Bay	WI	(414)	494-0917
Livermore	CA	(415)	443-9202
Oakland	CA	(415)	531-1820
San Mateo	CA	(415)	591-5591
Walnut Creek	CA	(415)	[illegible]
San Francisco	CA	(415)	956-4191
Toledo	OH	(419)	244-0073
Little Rock	AR	(501)	224-9311
Louisville	KY	(502)	[illegible]
Owensboro	KY	(502)	683-0777
Portland	OR	(503)	232-1072
Salem	OR	(503)	362-2523
Eugene	OR	(503)	689-9800
Baton Rouge	LA	(504)	273-0184
New Orleans	LA	(504)	734-8150
Albuquerque	NM	(505)	265-1263
Los Alamos	NM	(505)	662-4122
Medfield	MA	(508)	359-7603
Westborough	MA	(508)	366-2617
Concord	MA	(508)	371-0354
Hudson	MA	(508)	[illegible]
Brockton	MA	(508)	588-3222
Billerica	MA	(508)	[illegible]
Lawrence	MA	(508)	687-0374
Worcester	MA	(508)	792-2512
Framingham	MA	(508)	875-3814
Spokane	WA	(509)	326-0515
San Antonio	TX	(512)	[illegible]
Austin	TX	(512)	444-7234
Laredo	TX	(512)	[illegible]
Corpus Christi	TX	(512)	[illegible]
Dayton	OH	(513)	461-1064
Cincinnati	OH	(513)	771-1630
Des Moines	IA	(515)	270-9410
Williston Park	NY	(516)	[illegible]
Hicksville	NY	(516)	932-1470
Lake Grove	NY	(516)	[illegible]
Lansing	MI	(517)	487-2140
Saginaw	MI	(517)	893-1161
Albany	NY	(518)	439-7491
Jackson	MS	(601)	948-6411
Phoenix	AZ	(602)	[illegible]
Sierra Vista	AZ	(602)	[illegible]
Tucson	AZ	(602)	748-2009
Yuma	AZ	(602)	782-7191
Nashua	NH	(603)	883-5551
Rapid City	SD	(605)	341-3733
Lexington	KY	(606)	259-3446
Ithaca	NY	(607)	257-0155
Binghamton	NY	(607)	724-1171
Madison	WI	(608)	256-6525
La Crosse	WI	(608)	785-7530
Atlantic City	NJ	(609)	645-8778
Cherry Hill	NJ	(609)	665-7555
Princeton	NJ	(609)	921-7066
Minneapolis	MN	(612)	342-2207
Cambridge	OH	(614)	[illegible]
Columbus	OH	(614)	457-2105
Granville	OH	(614)	[illegible]
Athens	OH	(614)	592-2109
Nashville	TN	(615)	366-1947
Gatlinburg	TN	(615)	436-2001
Oak Ridge	TN	(615)	483-2292
Knoxville	TN	(615)	522-0164
Chattanooga	TN	(615)	877-5804
Kalamazoo	MI	(616)	383-1247
Grand Rapids	MI	(616)	[illegible]
Mendon	MA	(617)	478-0653
Boston	MA	(617)	[illegible]
San Diego	CA	(619)	[illegible]
Palm Springs	CA	(619)	325-4584
San Marcos	CA	(619)	471-0960
Solana Beach	CA	(619)	481-3527
San Diego	CA	(619)	[illegible]
Encinitas	CA	(619)	753-2728
Reno	NV	(702)	323-4426
Las Vegas	NV	(702)	737-8883
Fairfax	VA	(703)	352-7500
Manassas	VA	(703)	368-5707
Roanoke	VA	(703)	563-8421
Alexandria	VA	(703)	841-9834
Asheville	NC	(704)	274-3991
Charlotte	NC	(704)	333-6654
Napa	CA	(707)	257-7710
Santa Rosa	CA	(707)	579-1490
Houston	TX	(713)	462-0202
Riverside	CA	(714)	359-7801
Anaheim	CA	(714)	520-9724
Newport Beach	CA	(714)	724-0778
Irvine	CA	(714)	851-0145
Pomona	CA	(714)	865-2229
San Bernadino	CA	(714)	881-1583
Niagara Falls	NY	(716)	284-3570
Rochester	NY	(716)	[illegible]
Buffalo	NY	(716)	874-3751
Limestone	NY	(716)	925-7042
Harrisburg	PA	(717)	[illegible]
York	PA	(717)	845-7631
Pueblo	CO	(719)	546-1891
Colorado Springs	CO	(719)	596-0910
Provo	UT	(801)	377-1120
Salt Lake City	UT	(801)	521-2890
Manchester Ctr	VT	(802)	362-5580
Burlington	VT	(802)	862-1575
Myrtle Beach	SC	(803)	[illegible]
Greenville	SC	(803)	[illegible]
Charleston	SC	(803)	[illegible]
Columbia	SC	(803)	783-5484
Hilton Head	SC	(803)	785-4970
Norfolk	VA	(804)	461-6128
Virginia Beach	VA	(804)	461-6167
Richmond	VA	(804)	741-0158
Hampton	VA	(804)	[illegible]
Charlottesville	VA	(804)	[illegible]
Bakersfield	CA	(805)	323-7691
Oxnard	CA	(805)	[illegible]
Thousand Oaks	CA	(805)	499-0371
San Luis Obispo	CA	(805)	[illegible]
Ventura	CA	(805)	643-0177
Santa Barbara	CA	(805)	682-2331
Lancaster	CA	(805)	[illegible]
Amarillo	TX	(806)	379-8411
Lubbock	TX	(806)	763-5081
Kailua	HI	(808)	[illegible]
Maui	HI	(808)	871-6310
San Juan	PR	(809)	728-3012
Evansville	IN	(812)	479-0165
Tampa	FL	(813)	237-8189
Winter Haven	FL	(813)	299-3311
Sarasota	FL	(813)	355-9331
St. Petersburg	FL	(813)	525-0378
Ft Myers	FL	(813)	[illegible]
Somerset	PA	(814)	443-6402
Erie	PA	(814)	[illegible]
Rockford	IL	(815)	968-3412
Kansas City	MO	(816)	474-3770
Ft Worth	TX	(817)	283-0041
Sierra Madre	CA	(818)	357-0971
N. Hollywood	CA	(818)	[illegible]
Van Nuys	CA	(818)	[illegible]
Memphis	TN	(901)	452-1710
Daytona Beach	FL	(904)	257-5019
Tallahassee	FL	(904)	[illegible]
Jacksonville	FL	(904)	396-7105
Pensacola	FL	(904)	434-3911
Panama City	FL	(904)	871-0660
Fairbanks	AK	(907)	479-4102
Anchorage	AK	(907)	[illegible]
Savannah	GA	(912)	355-0222
Albany	GA	(912)	435-9420
Macon	GA	(912)	471-0147
Topeka	KS	(913)	234-1051
Middletown	NY	(914)	[illegible]
Poughkeepsie	NY	(914)	473-2617
White Plains	NY	(914)	761-9360
El Paso	TX	(915)	565-4661
Midland	TX	(915)	697-8211
Abilene	TX	(915)	698-1111
So Lake Tahoe	CA	(916)	541-5940
Sacramento	CA	(916)	971-4681
Tulsa	OK	(918)	749-8801
Greensboro	NC	(919)	373-1635
Wilmington	NC	(919)	392-4700
Burlington	NC	(919)	584-3762
Winston-Salem	NC	(919)	725-1550
Raleigh	NC	(919)	[illegible]
Canada			
Edmonton	AB	(403)	466-4501
Toronto	ON	(416)	752-4150
Montreal	PQ	(514)	374-8961
Vancouver	BC	(604)	738-5157
Ottawa	ON	(613)	837-5427

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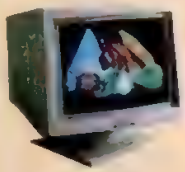
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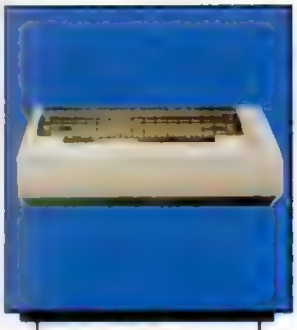


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■ PC LAB NOTES

CHOOSING A DOWNLOAD PROTOCOL

A protocol is used to ensure that the file you download is received without errors. PC MagNet currently supports a number of file transfer protocols, including Xmodem (MODEM7), CompuServe "B", CompuServe "A", DC4/DC2 CAPTURE, Kermit, and CompuServe Quick-B. Selecting which one of these to use is often dictated by what's available within your own communications software.

The two most commonly used protocols are Xmodem, a checksum-based protocol that is included in almost any PC-based communications program, and CompuServe Quick-B, a more advanced protocol that is specifically designed to optimize file transfer between PCs and the CompuServe network used by PC MagNet. If your software package supports it, we strongly recommend that you select Quick-B, as this minimizes the connect time needed to transfer the desired file(s).

To download a file from PC MagNet from within a forum library, enter the browse command, BRO, at the "Enter choice !" prompt. Browse is an easy way to view descriptions of the files available for downloading. If you already know the name of the file, you can specify it as part of the browse command, as, for example

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PC MagNet will display a description of the first available file. To download the file, enter DOW, or just D. PC MagNet will then present a menu of the available file transfer protocols. Choose the CompuServe Quick-B protocol if your software supports it. If not, choose a protocol that your software does support, such as Xmodem or Kermit.

Depending on your protocol choice, you may be asked to enter a filename for your computer. You can enter a complete file specification, including a drive letter and a path to the directory in which you want to store the received file. If you are asked to "initiate the transfer," you may have to instruct your software to start the actual transfer. If you're using the Xmodem protocol, for example, simply enter whatever commands your software requires to receive a file via Xmodem protocol.—**Salvatore P. Ricciardi**

rectory either by picking Select from the Read menu or by issuing the Browse command at a prompt. Don't be shy about leaving messages! If you have second thoughts, you can delete any message you posted (although you can't delete anyone else's—except those addressed to you).

Each forum has its own flavor. Here's a taste of each from some of the *PC Magazine* contributors who haunt them.—*Gus Venditto*

EDITORIAL FORUM One of the most fascinating forums is the Viewpoints-Dvorak Forum, where I have handpicked the smartest and most brilliant technical types in the world to scrutinize and discuss every aspect of every idea imaginable. These guys stun me every time I log on—and I try to log on once or twice a day. So if you have something profound to say or if you have a question of interest to the computing community, then check out the Dvorak section of the Editorial Forum. It's fantastic. Just log in and join in the fun. You'll know whether OS/2 will ever be a hit before the numbers are even posted.

All I can say for my group is that it proves that a columnist is only as good as his readers. I'm sure not smarter than any of these guys. Well, maybe one or two of them (but I'm not telling!). Also look for this section to find the most controversial discussions. If you like to be in the middle of a good fight, then check it out!—*John C. Dvorak*

Computers have fascinated me since I started reading science fiction in the early 1950s. I got my first computer kit in 1956 or '57. It was called a GENIAC, cost $19.95, and its biggest achievement was the ability to add two three-digit binary numbers to show a four-digit binary sum. From my first experiences with SOAP on an IBM 650 and FORTRAN on 7094s, through COBOL, assembly language, and PL/1 on IBM 360s and 370s, right up to Pascal, C, Prolog, LISP, Forth, and C++ on personal computers, I've never lost that early fascination.

■ If you like a good fight, check out the Viewpoints Forum—and Dvorak.

Even more fascinating for me is watching the industry and where it's going. That's really what I aim to do in my column and my section on PC MagNet. I see the latter as a forum to discuss the critical battles of the day: OS/2 vs. Unix; MCA vs. EISA; the battle to define the user interface of the future; the spreadsheet, word processing, database, and networking wars; and, most of all, the successful guerrilla battle of microprocessor-based systems against the proprietary mainframe and minicomputer dinosaurs. So why don't you join me in Section 10 of Editorial Forum to share and exchange views and ideas on these strategically vital issues.—*William F. Zachmann*

Confused about the current state of the computer arena? Annoyed about your inability to make sense of it? Enraged that it should all be so perplexing? Me, too. So I won't promise to solve your thorniest problems or tell you how to install a dual-ported carburetor on your Clown 386XS. But I do promise to give the important issues a thorough airing (not to mention a good thrashing when necessary), offer plenty of sympathy and commiseration, and keep my mouth shut and my fingers clenched when I don't have the foggiest

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■ PC LAB NOTES

idea about a topic. At times we'll even go off on wild tangents and talk about things only remotely related to computers—such as human beings.—*Stephen Manes*

UTILFORUM You say you're having problems running a *PC Magazine* utility? You can't get SNIPPER to snip? ASPRN makes you want to take a powder? Not to worry—head over to the Utilforum and talk to the folks who actually wrote the programs. The Utilforum's message sections are dedicated to giving *PC Magazine* readers advice on the ins and outs of our programs and routines.

In the forum libraries, you'll find all of *PC Magazine*'s utilities. If you're looking for a program from a recent issue, look in Library 0—New Uploads. After 30 days all *PC Magazine* programs are moved to Library 9—Utilities—where they can be easily accessed. We even have a library for shareware. That's Library 8, reserved for programs written by members of the Association of Shareware Professionals.—*Christopher Barr*

PROGRAMMING FORUM Have you ever had a dream in which you find yourself in a strange city, a place where the street signs are in a foreign language, and none of the directions make any sense?

That's almost what it's like when you start programming for OS/2 and the Presentation Manager. Programming has never been easy, and it's not getting any easier. But if you want help, the PC MagNet Programming Forum is the place to find it. I log onto PC MagNet several times a day, and I like to see questions because that means people are working on programs that the rest of us may someday use.

So, whether you've just started with OS/2 or are well along, if you have a question about OS/2 or Presentation Manager programming, just ask. The Programming Forum is quickly gaining a wide reputation as a meeting place for OS/2 programmers, so if I can't answer your questions, there's sure to be someone around who can. —*Charles Petzold*

It's a cold, cruel, confusing world for the programmer these days, what with countless operating systems and programming languages all competing for your pocketbook and, worse yet, for your valuable time. PC MagNet can help you make sense of it all. If you join us in the Programming Forum, you will be treated to nightly discussions with—and advice from—PC experts, consultants, authors, and gurus of every creed and persuasion. You may find our Programming Forum provocative, you may find it informative, you may find it witty—but there is one thing for certain, you will never find that it is boring.—*Ray Duncan*

TIPS AND TECHNIQUES FORUM You're a Power User—admit it. Your fellow workers come to you with questions about word processing, spreadsheets, databases, all the programs they use. You keep up to date by reading the Power User column in *PC Magazine*. But when even you get stumped, just log onto PC MagNet and visit the Tips and Techniques Forum. Between them, our editors have used an amazing percentage of the vast number of applications not only in the areas mentioned above, but in desktop publishing, accounting, telecommunication, and more. And they answer right away. And our readers' experiences cover an even wider range.

PC Magazine's User-to-User column gives you great batch files, patches, and other DOS tips in every issue. But what if one of them just doesn't work on your particular system? Perhaps one of your fellow readers has the exact same system configuration and has found a workaround. Or the editors may already know about your problem and have a solution waiting. Again, the answer is to log onto PC MagNet's Tips and Techniques Forum.

NAVIGATING PC MAGNET

The entire PC MagNet system is menu driven, so it's easy to find your way around, but learning a few commands will help you move even faster. When you've mastered the basic commands, you may wish to turn off the menus and work directly in the command mode. You can do this from the Options menu. Throughout the service, the exclamation point (!) is the most common prompt for a choice or command.

THE GO COMMAND Issued together with a destination, the GO command takes you directly to any forum or other place in PC MagNet. To illustrate, here are some of the useful GO commands:

- GO EDITORIAL (to get to the Editorial Forum)
- GO PHONES (for a list of local access numbers)
- GO PROFILE (to set user options)
- GO INSTRUCTIONS (to access general system information)

GENERAL COMMANDS Here are some of the more-frequently used navigating commands:

Ctrl-S—Suspends or freezes the screen so that you can read it. Then just hit any key to get started again.

Ctrl-C—Cancels the command being executed. This is useful if you've stumbled into an area in which you're not interested. The command may take a few seconds to work, since a large stream of data is probably on its way to you.

T—Returns you to the TOP level of PC MagNet.

M—Brings you to the top of the section menu; it's useful if you've chosen the wrong command and want to try again.

H (or ?)—Calls context-sensitive help. It's a smart idea to save all of the advice to a text file that you can refer to off-line.

READ—Works in forums only, accesses the hundreds of messages stored, starting with the oldest message you haven't read.

REPLY—For answering the message you've just read.

OP—Brings up your personal options menu. One important option is your high message in a forum. If you want to reread old messages that you've already seen, you change the high message here.

BYE (or OFF)—Signs off and disconnects.—**Gus Venditto**

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■ PC LAB NOTES

And while you're on-line, you should check out the other conversations. You may know the answer to another reader's question and you can earn the reward of satisfaction that comes from helping out. —*Neil J. Rubenking*

Home of LAN Wizards. One of the regulars on the Connectivity Clinic Forum uses the motto "Networks are My Life" on his business card. That sums up the attitude of many of the people available to answer your questions and help you make the best buying choices when you need to hook one PC to another computer or communications service.

■ The Utilities Database is where you'll find every program that's been in *PC Magazine*.

Any topic, from the best low-cost LAN for a particular application to alternatives for exchanging data with a mainframe, is fair game on this section of the Tips and Techniques Forum. You don't have to be a LAN guru to participate, but if you want to learn about advanced topics like NetBIOS programming and fiber-optic signaling standards, we can help.

If you need to share a printer, exchange a file, install e-mail, or let ten people use the same data file at the same time, the helpful folks on the Connectivity Clinic Forum have opinions, ideas, and insight they will freely share. Connect with us today!—*Frank J. Derfler, Jr.*

UTILITIES DATABASE Not to be confused with the Utilforum, the Utilities Database is where you'll find every *PC Magazine* program, batch file, routine, index, and PC Labs Benchmark Test ever made available by the magazine. It's an easy-to-use database, but unlike PC MagNet's forums, you can't send messages to it. We've developed a search engine to help

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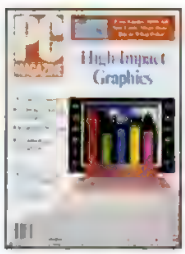
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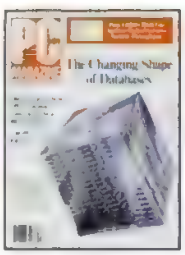
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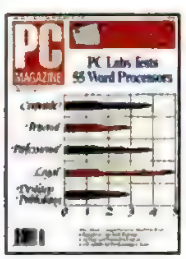
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CIRCLE 171 ON READER SERVICE CARD

■ PC LAB NOTES

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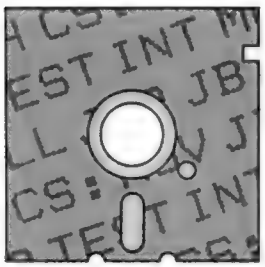
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CIRCLE 372 ON READER SERVICE CARD

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■ UTILITIES ■ MICHAEL HOLMES AND BOB FLANDERS

LANDSCAPE MODE TO THE RESCUE



You can save time and paper printing out program listings and other ASCII files on your LaserJet. This handy formatting utility puts two full pages on a single sheet.

As ream after ream disappears into the maw of your laser printer, you may find yourself mordantly recalling that not long ago people confidently predicted the coming of the "paperless office." It's so easy today to print out a fresh copy of a slightly modified file that laser printers are becoming an ecological threat.

You can simultaneously salve your conscience and speed your work, however, by using LASERLST. This utility formats text files so that two 66-line by 81-character pages of information are printed out side by side on a single page, as Figure 1 illustrates. The result does more than cut your paper costs in half. In many applications, such as tracing through program listings or editing rough drafts that may need reorganization, it's important to put as much information as conveniently possible on a single page so that you can see it as a whole.

To give credit where it's due, the idea for LASERLST came from PPRINT, a shareware program created by Norm Patriquin. PPRINT is available for downloading from many user BBSs and offers many additional capabilities. LASERLST concentrates simply on accurately emulating PPRINT's 2up facility.

As explained in the accompanying sidebar "LASERLST by Modem," a ready-to-run copy of LASERLST can be downloaded from PC MagNet. Its assembly-language source code, LASERLST .ASM, is printed here, as is the listing, LASERLST.BAS, which will automatically create LASERLST.COM when you run it once in BASIC. Both LASERLST .ASM and LASERLST.BAS can also be downloaded from PC MagNet.

USING LASERLST In order to use LASERLST, you must have an HP LaserJet or compatible printer. The program itself is approximately 1,500 bytes long, though it may actually require up to 36K while running. The command syntax for LASERLST is

```
[d:][path]LASERLST infile [outfile] [/Tn]
```

The *infile* parameter is the DOS filename to be printed by LASERLST. This parameter may be a fully qualified filename; that is, it may contain the drive and path where the file(s) can be found. For ease in print-

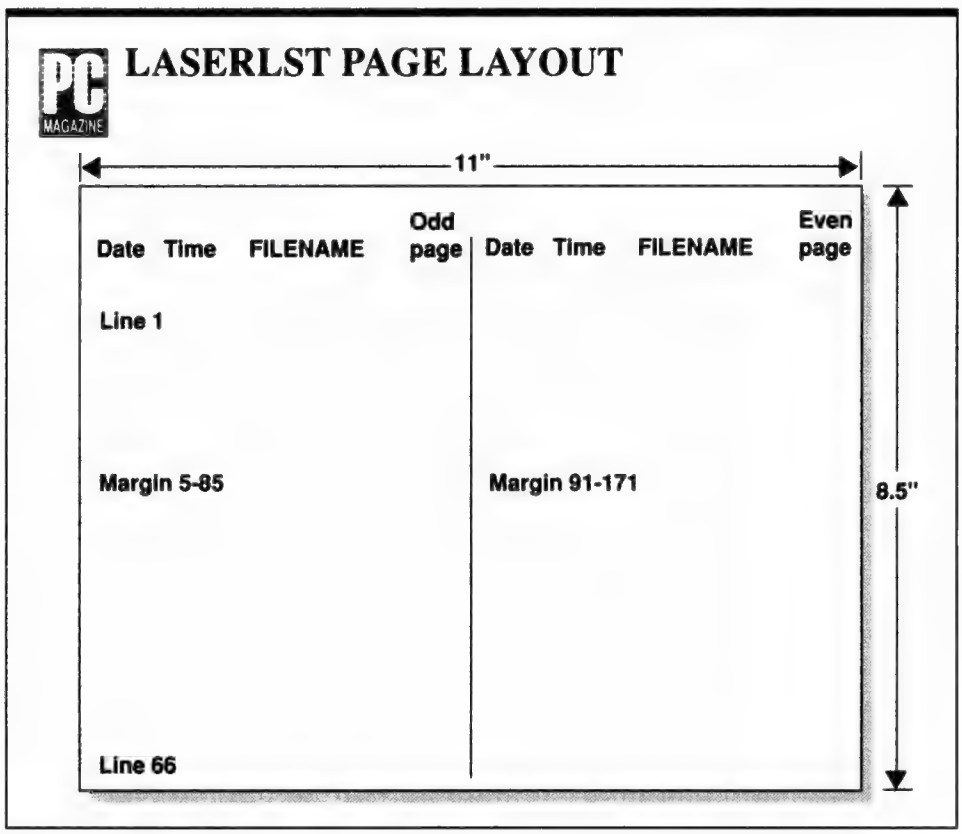


Figure 1: *This is the page format used by LASERLST to print two regular pages on one page in landscape mode. Using LASERLST will help you cut your paper costs in half.*

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■ UTILITIES

ing multiple related files, the *infile* parameter also supports the DOS wildcard characters (* and ?).

The optional *outfile* parameter is the DOS filename (or device) where the output is to be sent. If you omit this parameter, LASERLST simply sends its output to the standard printer device (officially, DOS handle 4), which is normally your LPT1 port. If your laser printer is hooked up to LPT2, just specify LPT2 as the *outfile*. Or, by supplying a drive and legal filename as the *outfile* parameter, you can save the output (which includes the necessary formatting codes) on a diskette that you can take to another machine to which a laser printer is attached. There, you can use the DOS

```
COPY outfile PRN
```

command to print the file.

The optional /T*n* switch is used to tell LASERLST the width to allow for tab stops. By default, tab stops are set to 8, as in DOS, but you can supply a value of up to 16 for *n*.

There are a few caveats to observe when using LASERLST. First, the file to be printed should be a pure text file. That is, the file should contain only printable characters, carriage returns (13 decimal, 0D hex), line feeds (10 decimal, 0A hex), backspaces (8 decimal and hex), tabs (9 decimal and hex), and form feeds (12 decimal, 0C hex). Including other characters—especially escape sequences that would affect a laser printer—may make the output unreadable. On the other hand, some word processors' formatting codes will simply print out in their ASCII form where they occur in the text without otherwise affecting LASERLST's output.

Second, as a general rule, the file should not contain printable lines longer than 81 characters. Longer lines will be broken after the 81st character, and the remainder will be printed on subsequent lines, as necessary. Usually, LASERLST

```
                PAGE    75,132
                TITLE   "LASERLST - List file to HP LaserJet"

CSEG            SEGMENT PARA PUBLIC 'CODE'
                ASSUME  CS:CSEG, DS:CSEG, ES:CSEG, SS:CSEG
                ORG     100H

START:          JMP     MAIN                    ; go to start of program

HEADER_MSG      DB      "LaserLst 1.0 (c) 1989 Ziff Communications Co.", 0DH,0AH
                DB      "PC Magazine",254," Michael Holmes & Bob Flanders",0DH,0AH
CRLF            DB      0DH,0AH
DOLLAR          DB      "$"
; ---------------------------------------------------------------------------
;   Initialized work areas
; ---------------------------------------------------------------------------
ARG1            DW      0                       ; addr of first argument
ARG2            DW      0                       ; addr of second argument
PHANDLE         DW      4                       ; printer handle (stdprn)
TABCOL          DW      8                       ; tab width
NEWPAGE         DB      0                       ; new page requested flag
HPSTATE         DB      0                       ; printer state  (1 = initialized)

TITLE_          DB      1BH,"&dD"               ; title line for heading
TITLE_DTE       DB      "mm/dd/yyyy  "          ; ..and display
TITLE_TME       DB      "hh:mm       Filename: "
TITLE_FLE       DB      19 dup(32)
TITLE_DSP       EQU     $-TITLE_DTE
                DB      "                    Page"
TITLE_PGE       DB      "xxxx",0dh,0ah,0ah
                DB      1BH,"&d@"
TITLE_LEN       EQU     $-TITLE_                ; length of title
;---------------------------------------------------------------------------
;   DTA structure for DOS "find matching" call
;---------------------------------------------------------------------------
DTA             EQU     80H                     ; dta offset
DTA_ATTR        EQU     BYTE PTR DTA+21         ; file attribute
DTA_TIME        EQU     WORD PTR DTA_ATTR+1     ; file time
DTA_DATE        EQU     WORD PTR DTA_TIME+2     ; file date
DTA_LSIZ        EQU     WORD PTR DTA_DATE+2     ; file lsw of size
DTA_HSIZ        EQU     WORD PTR DTA_LSIZ+2     ; file msw of size
DTA_NAME        EQU     BYTE PTR DTA_HSIZ+2     ; file name of file
DTA_LEN         EQU     DTA_NAME+15-DTA         ; length of dta find entry
;---------------------------------------------------------------------------
;   Messages to user
;---------------------------------------------------------------------------
FILENF          DB      "File not found.",0DH,0AH,"$"
PRTOERR         DB      "Could not open output file.",0DH,0AH,"$"
FORMAT          DB      0DH,0AH,"SYNTAX:",09H,"LASERLST [d:][path]filename[.ext] "
                DB      "[outfile] [/Tn]",0DH, 0AH, 0AH
                DB      "  ofile defaults to LPT1:",0DH,0AH
                DB      "  n is tab width (16 max)",0DH,0AH,"$"
;---------------------------------------------------------------------------
;   HP control strings
;---------------------------------------------------------------------------
STRING1         DB      1BH,"E",1BH,"&l1O",1BH,"(s17H",1BH,"&l5.14C"
                DB      1BH,"(s17F",1BH,"&l6E",1BH,"(s-3B"
                DB      1BH,"&a0R",1BH,"&a85M",1BH,"&a5L",0DH
STRING1_LEN     EQU     $-STRING1

STRING2         DB      0ch,1BH,"E"
STRING2_LEN     EQU     $-STRING2

STRING3         DB      1BH,"&a0R",1BH,"&a99M",1BH,"&a88L",0DH,0AH,0DH,0AH
STRING3_LEN     EQU     $-STRING3

STRING4         DB      "|", 0DH,0AH

STRING5         DB      1BH,"&a0R",1BH,"&a171M",1BH,"&a91L",0DH
STRING5_LEN     EQU     $-STRING5

STRING6         DB      0CH,1BH,"&a0R",1BH,"&a85M",1BH,"&a5L",0DH
STRING6_LEN     EQU     $-STRING6
; ---------------------------------------------------------------------------
;   MAIN - Mainline of program
; ---------------------------------------------------------------------------
MAIN            PROC                            ; start of program

                CALL    INIT                    ; initialize program

MAIN10:         CALL    OPEN                    ; open the input file
                JC      MAIN80                  ; if we can't .. try next

MAIN20:         CALL    READ                    ; read a block

                CALL    PRINT                   ; print the line

                OR      SI, SI                  ; q. end of file?
                JNZ     MAIN20                  ; a. no .. get next line

                MOV     BX, PHANDLE             ; bx = input file handle
                MOV     AH, 3EH                 ; ah = close file
                INT     21H                     ; .. ask DOS to do it

MAIN80:         MOV     AH, 4FH                 ; ah = find next file
                INT     21H                     ; q. file found?
                JNC     MAIN10                  ; a. yes .. continue

                MOV     DX, OFFSET DOLLAR       ; dx -> null message
                CALL    DIE                     ; .. say goodnight

MAIN            ENDP
; ---------------------------------------------------------------------------
;   INIT - Handle initialization
; ---------------------------------------------------------------------------
INIT            PROC

                CLD                             ; assure ascending
                MOV     AH, 19H                 ; ah = get current drive
                INT     21H                     ; al = current drive
                MOV     EDRV, AL                ; save entry drive

                MOV     SI, OFFSET EDIR         ; si -> current directory area
                MOV     BYTE PTR [SI], '\'      ; .. start with backslash
                INC     SI                      ; si -> next byte
                XOR     DL, DL                  ; dl = default drive
                MOV     AH, 47H                 ; ah = get current dir
                INT     21H                     ; .. save in area

                MOV     DX, OFFSET HEADER_MSG   ; dx -> header message
                MOV     AH, 9                   ; ah = print ascii$ message
                INT     21H                     ; .. ask DOS to do it

                CALL    PARMS                   ; check parameters

                CMP     ARG2, 0                 ; q. arg2 specified?
                JE      INIT20                  ; a. yes .. skip open

                MOV     DX, ARG2                ; dx -> arg2 value
                MOV     AH, 3CH                 ; ah = create file
                XOR     CX, CX                  ; .. cx = file attributes
                INT     21H                     ; q. open the file ok?
                JNC     INIT10                  ; a. yes .. continue

                MOV     DX, OFFSET PRTOERR      ; dx -> open error message
                CALL    DIE                     ; .. you're dead, Jim.

INIT10:         MOV     PHANDLE, AX             ; save printer handle
INIT20:         CALL    DYLPATH                 ; set up dir & drive

                MOV     AH, 4EH                 ; ah = find first
                MOV     DX, OFFSET FILENAME     ; dx -> file to find
                XOR     CX, CX                  ; cx = search attribute
                INT     21H                     ; q. find first file ok?
                JNC     INIT90                  ; a. yes .. continue

                MOV     DX, OFFSET FILENF       ; dx -> file not found
                CALL    DIE                     ; .. gasp you're final breath

INIT90:         RET                             ; return to caller

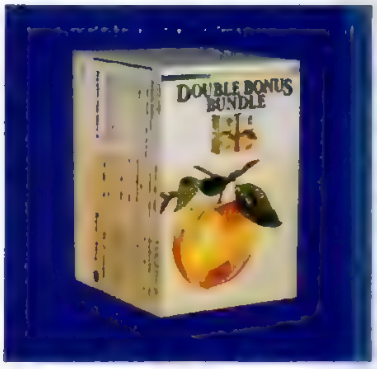
INIT            ENDP
```

(continues)

LASERLST.ASM: *The assembly-language source code for LASERLST.COM, which enables you to print two pages of text files on a single sheet of paper by using your laser printer's landscape mode.*

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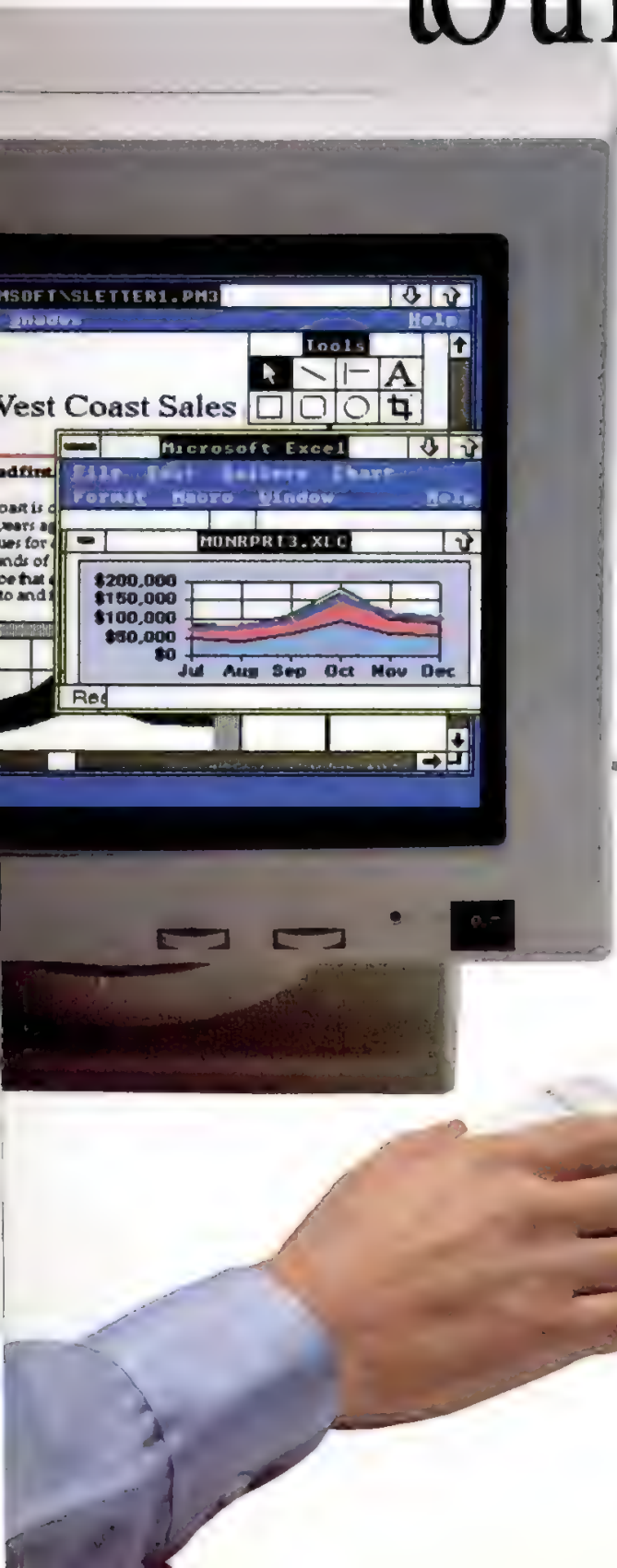
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COMPUTING

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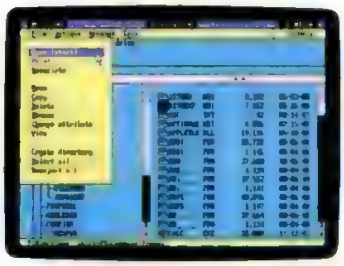


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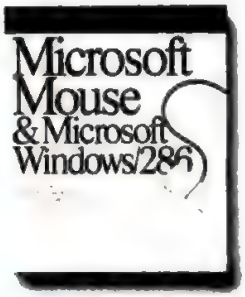
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```
; ---------------------------------------------------------------------------
;   OPEN - Opens the next file to process and update title line
;     Exit: Carry indicates file would not open.
; ---------------------------------------------------------------------------
OPEN        PROC

            MOV     DX, OFFSET DTA_NAME     ; dx -> file name
            MOV     AX, 3D00H               ; al = open for read
            INT     21H                     ; .. ask DOS to do it.
            JNC     OPEN05                  ; ok .. continue

            RET                             ; else .. return if error

OPEN05:     MOV     FHANDLE, AX             ; save file handle
            MOV     LASTBUFF, 0             ; show last buffer not read

            MOV     SI, OFFSET DTA_NAME     ; si -> file name
            MOV     DI, OFFSET TITLE_FLE    ; di -> file name area
            PUSH    DI                      ; .. save it
            MOV     AL, ' '                 ; al = blank
            MOV     CX, 15                  ; .. amount to blank
      REP   STOSB                           ; .. clear the file name
            POP     DI                      ; .. restore output pointer

OPEN10:     LODSB                           ; al = byte from file name

            OR      AL, AL                  ; q. end of name?
            JZ      OPEN20                  ; a. yes .. end loop

            STOSB                           ; store a byte
            JMP     OPEN10                  ; .. and move next

OPEN20:     MOV     BL, '0'                 ; fill value
            MOV     AX, DS:DTA_DATE         ; ax = date field
            PUSH    AX                      ; save for later
            PUSH    AX                      ; .. again

            MOV     CL, 5                   ; cl = shift value
            SHR     AX, CL                  ; .. mm to lower bits
            AND     AX, 0FH                 ; .. upper bits off
            MOV     CX, 2                   ; cx = number of characters
            MOV     DI, OFFSET TITLE_DTE    ; di -> mm
            CALL    ITOA                    ; .. move in mm

            POP     AX                      ; ax = date
            AND     AX, 1FH                 ; al = dd
            MOV     CX, 2                   ; cx = number of chars
            MOV     DI, OFFSET TITLE_DTE+3  ; di -> dd
            CALL    ITOA                    ; .. move into dd

            POP     AX                      ; ax = date
            MOV     CL, 9                   ; cl = shift amount
            SHR     AX, CL                  ; .. ax = yy
            ADD     AX, 1980                ; ax = year
            MOV     CX, 4                   ; cx = length of output
            MOV     DI, OFFSET TITLE_DTE+6  ; di -> yyyy
            CALL    ITOA                    ; .. move into yyyy

            MOV     AX, DS:DTA_TIME         ; ax = time
            PUSH    AX                      ; .. save for later
            MOV     CL, 11                  ; cl = shift value
            SHR     AX, CL                  ; .. ax = hh
            MOV     CX, 2                   ; cx = length of output
            MOV     DI, OFFSET TITLE_TME    ; di -> hh
            CALL    ITOA                    ; .. move into hh

            POP     AX                      ; ax = time
            MOV     CL, 5                   ; cl = shift value
            SHR     AX, CL                  ; ax = mm
            AND     AX, 3FH                 ; .. upper bits off
            MOV     CX, 2                   ; cx = length of output
            MOV     DI, OFFSET TITLE_TME+3  ; di -> mm
            CALL    ITOA                    ; .. move into mm

            MOV     AH, 40H                 ; ah = write to device
            MOV     BX, 1                   ; bx = stdout device
            MOV     CX, TITLE_DSP           ; cx = length to display
            MOV     DX, OFFSET TITLE_DTE    ; dx -> part of header line
            INT     21H                     ; issue dos call

            MOV     AH, 40H                 ; ah = write to device
            MOV     BX, 1                   ; bx = stdout device
            MOV     CX, 2                   ; cx = length to display
            MOV     DX, OFFSET CRLF         ; dx -> <cr><lf> string
            INT     21H                     ; issue dos call

            CLC                             ; show all went ok
OPEN90:     RET

OPEN        ENDP
; ---------------------------------------------------------------------------
;   READ - Read the next buffer full
;     Exit: si -> next line, 0 if eof, cx =  length of line
; ---------------------------------------------------------------------------
READ        PROC

            PUSH    AX                      ; save registers
            PUSH    BX
            PUSH    DX

            MOV     SI, 0                   ; si -> nothing

            CMP     LASTBUFF, 1             ; q. last buffer have 1ah?
            JE      READ90                  ; a. yes .. end it all

            MOV     AH, 3FH                 ; ah = read file
            MOV     BX, FHANDLE             ; bx = handle of file to read
            MOV     CX, BUFLEN              ; cx = amount to read
            MOV     DX, OFFSET BUFFER       ; dx -> buffer
            INT     21H                     ; read, please
            JC      READ90                  ; error .. return eof

            OR      AX, AX                  ; q. any read?
            JZ      READ90                  ; a. yes .. return with something

            MOV     SI, OFFSET BUFFER       ; si -> start of line
            MOV     CX, AX                  ; cx = nbr of characters read
            MOV     BX, AX                  ; .. and bx
            MOV     DI, SI                  ; di -> chars read
            MOV     AL, 1AH                 ; al = EOF indicator

    REPNE   SCASB                           ; q. eof found?
            JNE     READ80                  ; a. no .. continue

            INC     CX                      ; .. increment count
            NEG     CX                      ; .. and negate it
            MOV     LASTBUFF, 1             ; .. and set lastbuff flag

READ80:     ADD     CX, BX                  ; q. any bytes this buffer?
            JNZ     READ90                  ; a. yes .. continue

            MOV     SI, 0                   ; a. else .. show end of file.

READ90:     POP     DX                      ; restore registers
            POP     BX                      ;
            POP     AX                      ;
            RET                             ; ..and return to caller

READ        ENDP
; ---------------------------------------------------------------------------
;   PRINT - Print requested data
;     Entry: si -> string to print or 0, cx =  length of input string
; ---------------------------------------------------------------------------
PRINT       PROC

            OR      SI, SI                  ; q. end of file call?
            JNE     PRINT10                 ; a. no .. continue

            CALL    EPILOGUE                ; put out trailing characters
            RET                             ; ..and return to caller

PRINT10:    PUSH    AX                      ; save registers
            PUSH    BX
            PUSH    CX
            PUSH    DX
            PUSH    SI

            CMP     NPSTATE, 0              ; q. initial state?
            JNE     PRINT20                 ; a. no .. continue

            CALL    PROLOGUE                ; send out initial string

PRINT20:    CALL    EXPAND                  ; handle tab expansion
            MOV     DX, SI                  ; dx -> start of new buffer
            MOV     BX, CX                  ; bx = nbr of chars in buffer
            XOR     CX, CX                  ; cx = nbr of chars to print
            MOV     AH, USEDLEN             ; ah = printed chars in this line

PRINT30:    LODSB                           ; al = first character

            CMP     AL, 0CH                 ; q. formfeed?
            JNE     PRINT40                 ; a. yes .. process it

            CALL    LINEPRT                 ; print the line
            CALL    PAGEBREAK               ; do a page break
            XOR     AH, AH                  ; ah = nbr of columns used
            DEC     BX                      ; bx = decrement remaining count
            INC     DX                      ; dx -> next printable character
            JMP     PRINT70                 ; ..and continue w/common code

PRINT40:    CMP     AL, 0AH                 ; q. linefeed?
            JNE     PRINT50                 ; a. no .. continue

            DEC     BX                      ; bx = remaining chars in buffer
            INC     CX                      ; cx = nbr of characters to print
            CALL    LINEPRT                 ; print the line
            XOR     AH, AH                  ; ah = nbr of columns used
            CALL    BUMPLINE                ; increment/test line counter
            JMP     PRINT70                 ; ..and continue w/common code

PRINT50:    CMP     AL, 0DH                 ; q. carriage return?
            JNE     PRINT55                 ; a. no .. continue
            JMP     SHORT PRINT57           ; ..and continue w/common code

PRINT55:    CMP     AL, 08H                 ; q. BackSpace?
            JNE     PRINT60                 ; a. no .. continue

            DEC     AH                      ; move back a column
            JNS     PRINT65                 ; .. but not beyond first

PRINT57:    XOR     AH, AH                  ; ah = start of line
            JMP     SHORT PRINT65           ; .. and continue

PRINT60:    INC     AH                      ; increment nbr of columns used
PRINT65:    INC     CX                      ; ..and nbr of chars to print
            DEC     BX                      ; decrement remaining char count

            CMP     AH, 81                  ; q. reached end of line?
            JL      PRINT70                 ; a. no .. continue

            CALL    LINEPRT                 ; print upto page width
            PUSH    CX                      ; save registers
            PUSH    DX                      ;
            MOV     DX, OFFSET CRLF         ; dx -> <cr><lf>
            MOV     CX, 2                   ; cx = string length
            CALL    WRITE                   ; print the crlf to do line wrapping
            POP     DX                      ; restore registers
            POP     CX                      ;
            XOR     AH, AH                  ; ah = nbr of columns used
            CALL    BUMPLINE                ; increment/test line counter

PRINT70:    OR      BX, BX                  ; q. anything left to check?
            JNZ     PRINT30                 ; a. yes .. loop till done

            CALL    LINEPRT                 ; print the line
            MOV     USEDLEN, AH             ; save nbr of columns used

            POP     SI                      ; restore registers
            POP     DX                      ;
            POP     CX                      ;
            POP     BX                      ;
            POP     AX                      ;
            RET                             ; ..and return to caller

PRINT       ENDP
; ---------------------------------------------------------------------------
```

(LASERLST.ASM continues)

■ UTILITIES

```
;   DIE - Display an error message and return to DOS
;     Entry: dx -> error message ended in dollar sign.
; ---------------------------------------------------------------------------
DIE         PROC

            MOV     AH, 9                   ; ah = print string
            INT     21H                     ; .. call dos to print error

            MOV     DL, EDRV                ; dl = drive to select
            MOV     AH, 0EH                 ; ah = select drive
            INT     21H                     ; .. select the drive

            MOV     DX, OFFSET EDIR         ; dx -> directory
            MOV     AH, 3BH                 ; ah = CHDIR request
            INT     21H                     ; .. ask DOS to do it

            MOV     AX, 4C88H               ; ax = exit
            INT     21H                     ; .. terminate routine

DIE         ENDP
; ---------------------------------------------------------------------------
;   PARMS - Parses the command line
; ---------------------------------------------------------------------------
PARMS       PROC

            CALL    UPCASE                  ; upper case the parm area
            MOV     SI, 81H                 ; si -> parms area

PARMS10:    LODSB                           ; get parameter character
            CMP     AL, '/'                 ; q. option?
            JE      PARMS80                 ; a. yes .. check option
            CMP     AL, 0DH                 ; q. end of line?
            JE      PARMS50                 ; a. yes .. exit
            CMP     AL, ' '                 ; q. blank?
            JNA     PARMS10                 ; a. yes .. skip
            CALL    ARG                     ; set the argument
            JC      PARMSERR                ; .. die on an error

PARMS30:    LODSB                           ; get next character
            CMP     AL, 0DH                 ; q. end of line?
            JE      PARMS50                 ; a. yes .. process
            CMP     AL, '/'                 ; q. start of option?
            JE      PARMS80                 ; a. yes .. process
            CMP     AL, ' '                 ; q. end of PARMS?
            JA      PARMS30                 ; a. no .. next char

            CALL    ENDPARM                 ; terminate parm string
            JMP     PARMS10                 ; .. look for next

PARMS50:    CALL    ENDPARM                 ; terminate parm string

            CMP     ARG1, 0                 ; q. PARMS 1 available?
            JE      PARMSERR                ; a. no .. error
            RET                             ; .. else .. return to caller

PARMS80:    CALL    ENDPARM                 ; terminate parm string
            LODSB                           ; al = option character

            CMP     AL, 'T'                 ; q. Tab width?
            JNE     PARMSERR                ; a. no .. error in option

            CALL    ATOI                    ; ax =  tab width

            CMP     AX, 16                  ; q. request greater than max?
            JG      PARMS10                 ; a. yes .. unreasonable

            MOV     TABCOL, AX              ; .. save tab width
            JMP     PARMS10                 ; .. continue scan

PARMSERR:   MOV     DX, OFFSET FORMAT       ; dx -> format message
            CALL    DIE                     ; abort

PARMS       ENDP
; ---------------------------------------------------------------------------
;   ARG - Setup pointers to the command line arguments
;     Entry: si -> second character in argument.
;     Exit: ARG1 or ARG2 pointers filled in.
;       Carry set if more than 2 arguments detected.
; ---------------------------------------------------------------------------
ARG         PROC

            DEC     BX, [SI-1]              ; bx -> argument
            CMP     ARG1, 0                 ; q. arg1 filled in?
            JNE     ARG10                   ; a. yes .. check 2
            MOV     ARG1, BX                ; save arg1 pointer
            JMP     SHORT ARG90             ; .. exit ok!

ARG10:      CMP     ARG2, 0                 ; q. arg2 filled in?
            JE      ARG20                   ; a. no .. fill it in
            STC                             ; else .. error
            RET                             ; .. and return to caller

ARG20:      MOV     ARG2, BX                ; save arg2 pointer
ARG90:      CLC                             ; show no error
            RET                             ; return to caller

ARG         ENDP
; ---------------------------------------------------------------------------
;   ENDPARM - Handle parameters which end in a colon
;     Entry: si -> first character past end of parameter
; ---------------------------------------------------------------------------
ENDPARM     PROC

            CMP     BYTE PTR [SI-2], ':'    ; q. argument end in a colon?
            JNE     ENDPARM10               ; a. no .. continue

            MOV     BYTE PTR [SI-2], 0      ; ..it doesn't any more
            RET                             ; ..and return

ENDPARM10:  MOV     BYTE PTR [SI-1], 0      ; end the parameter
            RET                             ; ..and return

ENDPARM     ENDP
; ---------------------------------------------------------------------------
;   DFLPATH - Setup the default drive and path
; ---------------------------------------------------------------------------
DFLPATH     PROC

            MOV     DI, ARG1                ; di -> first arg

DFLPATH10:  CMP     BYTE PTR [DI+1], ':'    ; q. drive specified?
            JNE     DFLPATH20               ; a. no .. use current drive
            MOV     DL, [DI]                ; dl = drive to use
            SUB     DL, 'A'                 ; get requested drive number
            MOV     AH, 0EH                 ; set requested drive
            INT     21H                     ; .. via dos
            ADD     DI, 2                   ; di -> next part

DFLPATH20:  PUSH    DI                      ; save pointer
            MOV     BX, DI                  ; bx -> start of area
            XOR     AL, AL                  ; al = search for null
            MOV     CX, 128                 ; very max to search
            CLD
    REPNE   SCASB                           ; find end of arg
            LEA     SI, [DI-1]              ; si -> nul
            MOV     CX, 0                   ; cx = 0 chars to move
            CMP     SI, BX                  ; q. any file name
            JE      DFLPATH80               ; a. no .. error

DFLPATH30:  DEC     SI                      ; si -> prev char
            CMP     BYTE PTR [SI], '\'      ; q. dir?
            JE      DFLPATH35               ; a. yes .. end of file name.
            INC     CX                      ; cx = char count
            CMP     SI, BX                  ; q. done?
            JE      DFLPATH37               ; a. yes .. move file name
            JMP     DFLPATH30               ; .. continue

DFLPATH35:  INC     SI                      ; si -> start of file name
DFLPATH37:  OR      CX, CX                  ; q. file name spec'd?
            JE      DFLPATH80               ; a. no .. error
            CMP     CX, 12                  ; q. too long?
            JA      DFLPATH85               ; a. yes .. error
            PUSH    SI                      ; save start pointer
            MOV     DI, OFFSET FILENAME     ; di -> file name
            INC     CX                      ; .. assure nul moves too
      REP   MOVSB                           ; .. move in the file name
            POP     SI                      ; restore start pointer
            POP     DI                      ; .. and dir pointer
            CMP     SI, BX                  ; q. at start of parm?
            JE      DFLPATH90               ; a. yes .. return
            INC     BX                      ; bx -> next char
            CMP     SI, BX                  ; q. root only given?
            JE      DFLPATH40               ; a. yes .. continue
            DEC     SI                      ; si -> last \

DFLPATH40:  MOV     BYTE PTR [SI], 0        ; make dir ASCIIZ
DFLPATH50:  MOV     DX, DI                  ; dx -> directory
            MOV     AH, 3BH                 ; ah = CHDIR opcode
            INT     21H                     ; .. change directory
            JNC     DFLPATH90               ; if ok .. continue
            JMP     SHORT DFLPATH85         ; dx -> baddir request

DFLPATH80:  MOV     DX, OFFSET FORMAT       ; dx -> no file specified
            CALL    DIE

DFLPATH85:  MOV     DX, OFFSET FILENF       ; dx -> invalid filename spec'd
            CALL    DIE

DFLPATH90:  RET                             ; return to caller

DFLPATH     ENDP
; ---------------------------------------------------------------------------
;   EXPAND - Handle tab expansion
;     Entry:
;       si -> line read from file ended by a linefeed
;       cx =  length of line
;     Exit:
;       si -> reformatted line in output buffer
;       cx =  new line length
; ---------------------------------------------------------------------------
EXPAND      PROC

            PUSH    AX                      ; save registers
            PUSH    BX
            PUSH    DX
            PUSH    DI

            MOV     DI, OFFSET OBUFF        ; di -> start of output buffer

EXPAND10:   LODSB                           ; al = character from input line

            CMP     AL, 09H                 ; q. tab character?
            JNE     EXPAND30                ; a. no .. continue processing

            MOV     AX, CURCOL              ; ax = current column
            DEC     AX                      ; ax = column offset
            XOR     DX, DX                  ; dx:ax = current column
            MOV     BX, TABCOL              ; bx = nbr of columns per tab
            IDIV    BX                      ; dx = space within tab stop

            SUB     BX, DX                  ; bx = spaces left in tab stop

            MOV     AL, 20H                 ; al = space char to padding string

EXPAND20:   STOSB                           ; put a blank in output buffer
            INC     CURCOL                  ; bump current column nbr

            DEC     BX                      ; q. done yet?
            JNE     EXPAND20                ; a. no .. keep looping
            JMP     SHORT EXPAND10          ; a. yes .. get next character

EXPAND30:   CMP     AL, 0DH                 ; q. carriage return?
            JE      EXPAND33                ; a. yes .. reset column

            CMP     AL, 0CH                 ; q. form feed?
            JNE     EXPAND35                ; a. no .. continue processing

EXPAND33:   MOV     CURCOL, 0               ; setup for start of new line
            JMP     SHORT EXPAND50          ; .. continue

EXPAND35:   CMP     AL, 08H                 ; q. backspace?
            JNE     EXPAND40                ; a. no .. continue

            STOSB                           ; save the BS
            DEC     CURCOL                  ; .. move back a space
```

(LASERLST.ASM continues)

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2. When you receive a Connect or Carrier Detected message, enter **Ctrl-C.**
3. At the HOST NAME prompt, enter **CIS.**
4. At the USER ID prompt, enter **177000, 5000.**
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7. Register your name and enter your **VISA, MasterCard,** or **American Express** account number.
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PC MAGNET

CIRCLE 497 ON READER SERVICE CARD

■ UTILITIES

```
            JNZ     EXPAND50                ; .. get next character

            MOV     CURCOL, 1               ; init current column
            JMP     SHORT EXPAND50          ; .. continue

EXPAND40:   STOSB                           ; move character to output line
            CMP     AL, 0AH                 ; q. line feed?
            JE      EXPAND50                ; a. yes .. don't count it

            INC     CURCOL                  ; bump current column nbr

EXPAND50:   LOOP    EXPAND10                ; ..loop till input exhausted

            MOV     SI, OFFSET OBUFF        ; si -> start of output buffer
            MOV     CX, DI                  ; di -> just past last char of
                                            ; output
            SUB     CX, SI                  ; cx = nbr of characters in output

            POP     DI                      ; restore registers
            POP     DX
            POP     BX
            POP     AX
            RET                             ; ..and return to caller

EXPAND      ENDP
; ---------------------------------------------------------------------------
;   LINEPRT - Handle printing a line
;     Entry:
;       dx -> start of line
;       cx =  nbr of characters to print
;     Exit:
;       dx -> start of next line
;       cx =  0
; ---------------------------------------------------------------------------
LINEPRT     PROC

            JCXZ    LINEPRT90               ; if nothing to print.. return

            CMP     NEWPAGE, 1              ; q. need a new page?
            JNE     LINEPRT10               ; a. no .. continue

            CALL    PAGEBREAK               ; else .. do a pagebreak

LINEPRT10:  CALL    WRITE                   ; write the line

            ADD     DX, CX                  ; dx -> start of next line
            XOR     CX, CX                  ; cx = nbr of characters to print
LINEPRT90:  RET

LINEPRT     ENDP
; ---------------------------------------------------------------------------
;   MKTITLE - Make the title line be ready to print
;     Exit:
;       dx -> title line
;       cx =  title line length
; ---------------------------------------------------------------------------
MKTITLE     PROC
            PUSH    AX                      ; save registers
            PUSH    BX
            PUSH    DI

            MOV     AX, PAGENO              ; ax = page number
            MOV     CX, 4                   ; cx = length of output
            MOV     BL, ' '                 ; bl = fill char (blank)
            MOV     DI, OFFSET TITLE_PGE    ; di -> output area
            CALL    ITOA                    ; .. fill in page number

            MOV     DX, OFFSET TITLE_       ; dx -> title
            MOV     CX, TITLE_LEN           ; cx = length of title
            CALL    WRITE                   ; print title line

            POP     DI                      ; restore registers
            POP     BX
            POP     AX
            RET                             ; return to caller

MKTITLE     ENDP
; ---------------------------------------------------------------------------
;   PAGEBREAK - Handle page overflow condition
; ---------------------------------------------------------------------------
PAGEBREAK   PROC

            PUSH    BX                      ; save registers
            PUSH    CX
            PUSH    DX

            TEST    PAGENO, 1               ; q. finishing up with left page?
            JZ      PAGEBRK20               ; a. no .. do other page

            MOV     DX, OFFSET STRING3      ; dx -> get to right page string
            MOV     CX, STRING3_LEN         ; cx = length
            CALL    WRITE                   ; write out 1st part of string

            MOV     BX, 66                  ; bx = loop count
            MOV     CX, 3                   ; cx = nbr of chars to print
            MOV     DX, OFFSET STRING4      ; dx -> vertical bar string

PAGEBRK10:  CALL    WRITE                   ; write on line of vertical bars

            DEC     BX                      ; q. done yet?
            JNZ     PAGEBRK10               ; a. no .. keep looping

            MOV     DX, OFFSET STRING5      ; dx -> string to finish up
            MOV     CX, STRING5_LEN         ; cx = length
            JMP     PAGEBRK30               ; ..and continue w/common code

PAGEBRK20:  MOV     DX, OFFSET STRING6      ; dx -> get to left page string
            MOV     CX, STRING6_LEN         ; cx = length

PAGEBRK30:  CALL    WRITE                   ; print the init line

            MOV     LINECNT, 1              ; reset line counter
            MOV     NEWPAGE, 0              ; clear new page request flag
            INC     PAGENO                  ; ..and bump page number

            CALL    MKTITLE                 ; print title line

            POP     DX                      ; restore registers
            POP     CX                      ;
            POP     BX                      ;
            RET                             ; ..and return to caller

PAGEBREAK   ENDP
; ---------------------------------------------------------------------------
;   BUMPLINE - Increment line counter and test for overflow
; ---------------------------------------------------------------------------
BUMPLINE    PROC
            INC     LINECNT                 ; increment line counter

            CMP     LINECNT, 66             ; q. reached max lines/page?
            JLE     BUMPLINE90              ; a. no .. continue

            MOV     NEWPAGE, 1              ; else .. show we'll need a new one

BUMPLINE90: RET                             ; ..then return to caller

BUMPLINE    ENDP
; ---------------------------------------------------------------------------
;   PROLOGUE - Put out laserjet initialization string
; ---------------------------------------------------------------------------
PROLOGUE    PROC

            PUSH    CX                      ; save registers
            PUSH    DX

            MOV     DX, OFFSET STRING1      ; dx -> initialization string
            MOV     CX, STRING1_LEN         ; cx = length
            CALL    WRITE                   ; print the init line

            MOV     PAGENO, 1               ; setup page number
            MOV     CURCOL, 1               ; ..and current column number
            MOV     LINECNT, 1              ; ..and line counter
            MOV     EPSTATE, 1              ; ..show in left page
            MOV     USEDLEN, 0              ; ..clear column position
            CALL    MKTITLE                 ; print title line

            POP     DX                      ; restore registers
            POP     CX                      ;
            RET                             ; ..and return to caller

PROLOGUE    ENDP
; ---------------------------------------------------------------------------
;   EPILOGUE - Put out laserjet finish up string
; ---------------------------------------------------------------------------
EPILOGUE    PROC

            PUSH    CX                      ; save registers
            PUSH    DX

            MOV     DX, OFFSET STRING2      ; dx -> termination string
            MOV     CX, STRING2_LEN         ; cx = length
            CALL    WRITE                   ; print the init line

            MOV     EPSTATE, 0              ; show back to initialization state

            POP     DX                      ; restore registers
            POP     CX                      ;
            RET                             ; ..and return to caller

EPILOGUE    ENDP
; ---------------------------------------------------------------------------
;   WRITE - Send a string to the printer
;     Entry:
;       dx -> string to write
;       cx =  nbr of characters
; ---------------------------------------------------------------------------
WRITE       PROC

            PUSH    AX                      ; save registers
            PUSH    BX

            MOV     AH, 40H                 ; ah = write to file/device function
            MOV     BX, PHANDLE             ; bx = printer handle
            INT     21H                     ; issue dos call

            POP     BX                      ; restore registers
            POP     AX                      ;
            RET                             ; ..and return to caller

WRITE       ENDP
; ---------------------------------------------------------------------------
;   UPCASE - Convert command line arguments to uppercase
; ---------------------------------------------------------------------------
UPCASE      PROC

            PUSH    SI                      ; save caller regs
            PUSH    DI
            MOV     SI, 81H                 ; si -> start of parm area
            MOV     DI, SI                  ; .. same for di
            CLD                             ; .. assure ascending

UPCASE10:   LODSB                           ; al = char
            CMP     AL, 0DH                 ; q. end of line?
            JE      UPCASE90                ; a. yes .. end of line:
            CMP     AL, 'a'                 ; q. is it below 'a'?
            JB      UPCASE20                ; a. yes .. continue
            CMP     AL, 'z'                 ; q. is it above 'z'?
            JA      UPCASE20                ; a. yes .. continue
            SUB     AL, 20H                 ; set to upper case

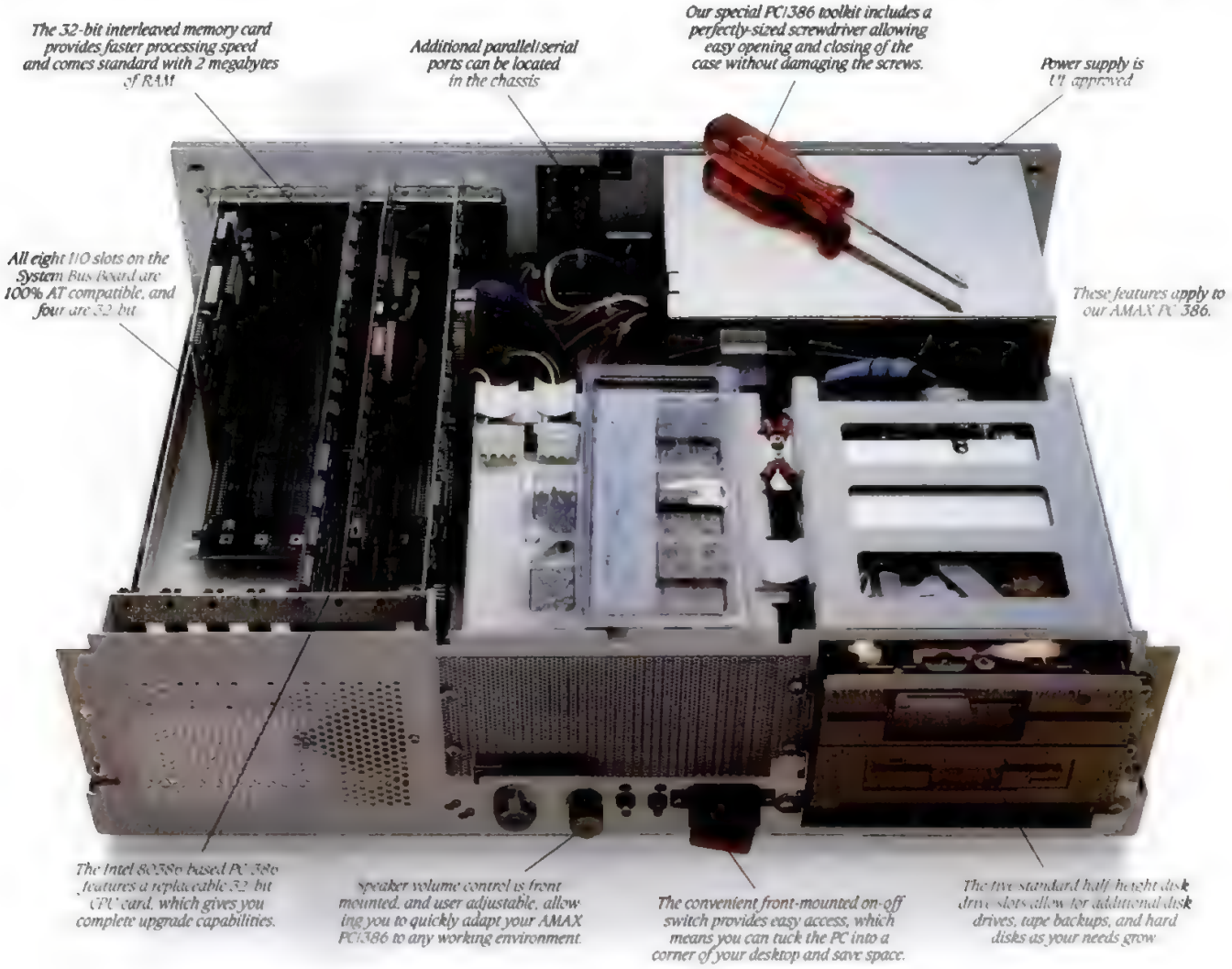
UPCASE20:   STOSB                           ; save the byte
            JMP     UPCASE10                ; .. and continue

UPCASE90:   POP     DI                      ; restore caller regs
            POP     SI
            RET                             ; .. and return to caller

UPCASE      ENDP
; ---------------------------------------------------------------------------
;   ATOI - Translate an ascii value to binary
;     Entry:
;       si -> ascii value
;     Exit:
;       al =  binary value
; ---------------------------------------------------------------------------
ATOI        PROC
```

(LASERLST.ASM continues)

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CIRCLE 179 ON READER SERVICE CARD

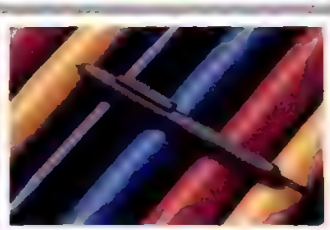


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CIRCLE 117 ON READER SERVICE CARD

■ UTILITIES

```
                XOR     AX, AX                  ; ax = accumulator = 0

ATOI10:         CMP     BYTE PTR [SI], '0'      ; q. below ascii 0?
                JB      ATOI90                  ; a. yes.. exit

                CMP     BYTE PTR [SI], '9'      ; q. above ascii 9?
                JA      ATOI90                  ; a. yes.. exit

                XOR     AH, AH                  ; reset ah
                MOV     BL, 10                  ; bl = multiply value
                MUL     BL                      ; .. multiply by 10
                MOV     BL, [SI]                ; bl = value
                AND     BL, 0FH                 ; .. upper bits off
                ADD     AL, BL                  ; .. add to bl

                INC     SI                      ; si -> next char
                JMP     ATOI10                  ; .. tranlate it

ATOI90:         RET                             ; .. return to caller

ATOI            ENDP
;---------------------------------------------------------------------------
;   ITOA - Integer to ASCII characters
;     Entry:
;       ax =  value to convert
;       bl =  fill character
;       cx =  nbr of characters
;       di -> start of alpha area
;---------------------------------------------------------------------------
ITOA            PROC

                PUSH    AX                      ; save registers
                PUSH    BX
                PUSH    CX
                PUSH    DX
                PUSH    DI
                PUSHF
                STD                             ; ..and set direction flag

                ADD     DI, CX                  ; di -> 1st char past work area
                DEC     DI                      ; di -> last char in work area
                PUSH    BX                      ; save fill character
                MOV     BX, 10                  ; bx = divisor

ITOA10:         OR      AX, AX                  ; q. any value to convert?
                JE      ITOA20                  ; a. no .. exit loop

                XOR     DX, DX                  ; dx:ax = value to divide
                IDIV    BX                      ; ax = dividend, dx = remainder
                OR      DL, 30H                 ; dl = ASCII number
                MOV     [DI], DL                ; store character in buffer
                DEC     DI                      ; di -> next output char location

                DEC     CX                      ; q. any more room in buffer?
                JNZ     ITOA10                  ; a. yes .. continue loop

                POP     BX                      ; restore register
                JMP     ITOA90                  ; ..and exit through common code

ITOA20:         POP     AX                      ; al = fill character

ITOA30:         STOSB                           ; store fill character

                DEC     CX                      ; q. any more room in buffer?
                JNZ     ITOA30                  ; a. yes .. continue loop

ITOA90:         POPF                            ; restore flags
                POP     DI                      ; ..and registers
                POP     DX                      ;
                POP     CX                      ;
                POP     BX                      ;
                POP     AX                      ;
                RET                             ; ..and return

ITOA            ENDP
;---------------------------------------------------------------------------
;   Uninitialized data areas
;---------------------------------------------------------------------------
UDATA           EQU     $                       ; start of unitialized data
PAGENO          EQU     WORD PTR UDATA          ; current page number
CURCOL          EQU     WORD PTR PAGENO+2       ; current column
LINECNT         EQU     WORD PTR CURCOL+2       ; line count
EDRV            EQU     BYTE PTR LINECNT+2      ; current disk
EDIR            EQU     BYTE PTR EDRV+1         ; current directory
FILENAME        EQU     BYTE PTR EDIR+65        ; filename specifed as ARG1
LASTBUFF        EQU     BYTE PTR FILENAME-13    ; last buffer indicator
FHANDLE         EQU     WORD PTR LASTBUFF+1     ; input file handle
BUFFER          EQU     BYTE PTR FHANDLE+2      ; file buffer
BUFLEN          EQU     2048                    ; length of buffer
USEDLEN         EQU     BYTE PTR BUFFER+BUFLEN  ; used length in a logical line
OBUFF           EQU     BYTE PTR USEDLEN+1      ; output buffer - must be last!

CSEG            ENDS                            ; end of code segment
                END     START
```

(LASERLST.ASM ends)

```
100 REM - BASIC PROGRAM TO CREATE LASERLST.COM
110 CLS:PRINT "Creating LASERLST.COM": OPEN "LASERLST.COM" AS #1 LEN = 1
120 FIELD #1, 1 AS A$: CHECKSUM#=0
130 FOR I = 1 TO   183
140  LINESUM#=0: LOCATE 2,3: PRINT "Countdown: "   183 - I ;
150  FOR J = 1 TO  16: READ BYTE$: BYTE = VAL("&H" + BYTE$)
160   CHECKSUM# = CHECKSUM# + BYTE: LINESUM# = LINESUM# + BYTE
170   IF (BYTE < 256) THEN LSET A$=CHR$(BYTE): PUT #1
180  NEXT J
190  READ LINETOT$: LINECHECK# = VAL("&H"+LINETOT$)
200  IF LINECHECK# = LINESUM# THEN GOTO 220
210  LOCATE 4,2: PRINT "Error in line #"  ;  260 +  10 * I: GOTO 260
220 NEXT I
230 CLOSE: READ FILETOT$ : FILECHECK# = VAL(FILETOT$)
240 IF CHECKSUM# <> FILECHECK# THEN GOTO 260
250 PRINT: PRINT "LASERLST.COM created successfully": SYSTEM
260 PRINT: PRINT "LASERLST.COM is not valid!": END
270 DATA E9, E0,  1, 4C, 61, 73, 65, 72, 4C, 73, 74, 20, 31, 2E, 30, 20,    5C3
280 DATA 28, 63, 29, 20, 31, 39, 38, 39, 20, 5A, 69, 66, 66, 20, 43, 6F,    430
290 DATA 6D, 6D, 75, 6E, 69, 63, 61, 74, 69, 6F, 6E, 73, 20, 43, 6F, 2E,    617
300 DATA  D,  A, 50, 43, 20, 4D, 61, 67, 61, 7A, 69, 6E, 65, FE, 20, 4D,    561
310 DATA 69, 63, 68, 61, 65, 6C, 20, 48, 6F, 6C, 6D, 65, 73, 20, 24, 20,    554
320 DATA 42, 6F, 62, 20, 46, 6C, 61, 6E, 64, 65, 72, 73,  D,  A,  D,  A,    490
330 DATA 24,  0,  0,  0,  0,  4,  0,  0,  0,  0,  0, 1B, 26, 64, 44, 6D,    106
340 DATA 6D, 2F, 64, 64, 2F, 79, 79, 79, 79, 20, 20, 68, 68, 3A, 6D, 6D,    59B
350 DATA 20, 20, 20, 20, 20, 20, 20, 46, 69, 6C, 65, 6E, 61, 6D, 65, 3A,    430
360 DATA 20, 20, 20, 20, 20, 20, 20, 20, 20, 20, 20, 20, 20, 20, 20, 20,    200
370 DATA 20, 20, 20, 20, 20, 20, 20, 20, 20, 20, 20, 20, 20, 20, 20, 20,    200
380 DATA 20, 20, 20, 20, 20, 20, 20, 20, 50, 61, 67, 65, 20, 20, 20, 20,    45D
390 DATA  D,  A,  A, 1B, 26, 64, 46, 46, 69, 6C, 65, 20, 6E, 6F, 74, 20,    417
400 DATA 66, 6F, 75, 6E, 64, 2E,  D,  A, 24, 43, 6F, 75, 6C, 64, 20, 6E,    59A
410 DATA 6F, 74, 20, 6F, 70, 65, 6E, 20, 6F, 75, 74, 70, 75, 74, 20, 66,    68C
420 DATA 69, 6C, 65, 2E,  D,  A, 24,  D,  A, 53, 59, 4E, 54, 41, 58, 3A,    3D8
430 DATA  9, 4C, 41, 53, 45, 52, 4C, 53, 54, 20, 5B, 64, 3A, 5D, 5B, 70,    4B4
440 DATA 61, 74, 68, 5D, 66, 69, 6C, 65, 6E, 61, 6D, 65, 5B, 2E, 65, 78,    641
450 DATA 74, 5D, 20, 5B, 6F, 75, 74, 66, 69, 6C, 65, 5D, 20, 5B, 2F, 54,    59F
460 DATA 6E, 5D,  D,  A,  A, 20, 20, 6F, 66, 69, 6C, 65, 20, 64, 65, 66,    48A
470 DATA 61, 75, 6C, 74, 73, 20, 74, 6F, 20, 4C, 50, 54, 31, 3A,  D,  A,    4BE
480 DATA 20, 20, 6E, 20, 69, 73, 20, 74, 61, 62, 20, 77, 69, 64, 74, 68,    541
490 DATA 20, 20, 31, 36, 20, 6D, 61, 78, 29,  D,  A, 24, 1B, 45, 1B, 26,    31A
500 DATA 6C, 31, 4F, 1B, 28, 73, 31, 37, 48, 1B, 26, 6C, 35, 2B, 31, 34,    3C7
510 DATA 43, 1B, 26, 6C, 37, 31, 46, 1B, 26, 6C, 36, 45, 1B, 26, 73, 2D,    3A9
520 DATA 33, 42, 1B, 26, 61, 30, 52, 1B, 26, 61, 30, 35, 4D, 1B, 26, 61,    397
530 DATA 35, 4C,  D,  C, 1B, 45, 1B, 26, 61, 30, 52, 1B, 26, 61, 39, 30,    329
540 DATA 4D, 1B, 26, 61, 30, 30, 4C,  D,  A,  D,  A, 7C,  D,  A, 1B, 26,    2AD
550 DATA 61, 30, 52, 1B, 26, 61, 31, 37, 31, 4D, 1B, 26, 61, 39, 31, 4C,    3C3
560 DATA  D,  C, 1B, 26, 61, 30, 52, 1B, 26, 61, 30, 35, 4D, 1B, 26, 61,    33B
570 DATA 35, 4C,  D, E8, 23,  0, E8, 78,  0, 72, 12, E8,  9,  1, E8, 4B,    59A
580 DATA  1,  B, F6, 75, F6, 0B, 1E, C5,  7, B4, 3E, CD, 21, B4, 4F, CD,    792
590 DATA 21, 73, E3, BA, 6B,  1, E8, BB,  1, FC, B4, 19, CD, 21, A2, 75,    084
600 DATA  7, BE, 76,  7, C6,  4, 5C, 46, 32, D2, B4, 47, CD, 21, BA,  3,    658
610 DATA  1, B4,  9, CD, 21, E8, B4,  1, 83, 3E, 63,  1,  0, 74, 15, 8B,    582
620 DATA 16, 63,  1, B4, 3C, 33, C9, CD, 21, 73,  6, BA, D9,  1, E8, 83,    6CC
630 DATA  1, AJ, 65,  1, E8, 14,  2, B4, 4E, BA, B7,  7, 33, C9, CD, 21,    66C
640 DATA 73,  6, BA, C7,  1, E8, 6C,  1, C3, BA, 9E,  0, B8,  0, 3D, CD,    72D
650 DATA 21, 73,  1, C3, AJ, C5,  7, C6,  6, C4,  7,  0, 90, BE, 9E,  0,    64A
660 DATA BF, 91,  1, 57, B8, 2B, B9,  F,  0, F3, AA, 5F, AC,  A, C8, 74,    726
670 DATA  3, AA, EB, F8, B3, 3B, A1, 98,  0, 50, 50, B1,  5, D3, E8, 25,    7E2
680 DATA  F,  0, B9,  2,  0, BF, 6F,  1, E8, A5,  3, 50, 25, 1F,  0, B9,    4DE
690 DATA  2,  0, BF, 72,  1, E8, 98,  3, 58, B1,  9, D3, E0,  5, BC,  7,    64C
700 DATA B9,  4,  0, BF, 75,  1, E8, B7,  3, A1, 96,  0, 50, B1,  3, D3,    67A
710 DATA E8, B9,  2,  0, BF, 7B,  1, E8, 76,  3, 58, B1,  5, D3, E8, 25,    72D
720 DATA 3F,  0, B9,  2,  0, BF, 7E,  1, E8, 65,  3, B4, 4B, BB,  1,  0,    538
730 DATA B9, 35,  0, BA, 6F,  1, CD, 21, B4, 4B, BB,  1,  0, B9,  2,  0,    571
740 DATA BA, 5E,  1, CD, 21, F8, C3, 50, 53, 52, BE,  0,  0, 8B, 3E, C4,    6F7
750 DATA  7,  1, 74, 34, B4, 3F, 8B, 1E, C5,  7, B9,  0,  0, 99, BA, C7,    5EA
760 DATA  7, CD, 21, 72, 23,  8, C8, 74, 1F, BE, C7,  7, 8B, C8, 8B, D8,    72A
770 DATA 8B, FE, B8, 1A, F2, AE, 75,  9, 41, F7, D9, C6,  6, C4,  7,  1,    01A
780 DATA 90,  3, CB, 75,  3, BE,  0,  0, 5A, 5B, 58, C3,  8, F6, 75,  4,    5DE
790 DATA E8, A3,  2, C3, 58, 53, 51, 52, 56, 80, 3E, 6A,  1,  0, 75,  3,    58D
800 DATA E8, 65,  2, E8, 74,  1, 8B, D6, 8B, D9, 33, C9, 8A, 26, C7,  F,    7F3
810 DATA AC, 3C,  C, 75,  D, E8, C2,  1, E8, F1,  1, 32, E4, 4B, 42, E8,    789
820 DATA 42, 90, 3C,  A, 75,  D, 4B, 41, E8, AF,  1, 32, E4, E8, 27,  2,    5E5
830 DATA EB, 31, 90, 3C,  D, 75,  2, EB,  8, 3C,  8, 75,  0, FE, CC, 79,    663
840 DATA  6, 32, E4, EB,  2, FE, C4, 41, 4B, 80, FC, 51, 7C, 15, E8, 89,    826
850 DATA  1, 51, 52, BA, 5E,  1, B9,  2,  8, E8, 4D,  2, 5A, 59, 32, E4,    578
860 DATA E8, F4,  1,  B, DB, 75, A9, E8, 78,  1, 88, 26, C7,  F, 5E, 5A,    776
870 DATA 59, 5B, 58, C3, B4,  9, CD, 21, 8A, 16, 75,  7, B4,  E, CD, 21,    646
880 DATA BA, 76,  7, B4, 3B, CD, 21, 88,  0, 4C, CD, 21, E8, 27,  2, BE,    6D5
890 DATA 81,  8, AC, 3C, 2F, 74, 2A, 3C,  D, 74, 1B, 3C, 2B, 76, F3, E8,    5BB
900 DATA 3A,  0, 72, 32, AC, 3C,  D, 74,  D, 3C, 2F, 74, 14, 3C, 2B, 77,    41A
910 DATA F3, E8, 47,  0, EB, DC, E8, 42,  0, 83, 3E, 61,  1,  0, 74, 16,    6C8
920 DATA C3, E8, 37,  0, AC, 3C, 54, 75,  D, E8,  7,  2, 3D, 10,  0, 7F,    55D
930 DATA C1, A3, 67,  1, EB, BC, BA, F7,  1, E8, 98, FF, 8D, 5C, FF, 83,    A8F
940 DATA 3E, 61,  1,  0, 75,  6, 89, 1E, 61,  1, EB,  D, 83, 3E, 63,  1,    441
950 DATA  0, 74,  2, F9, C3, 89, 1E, 63,  1, F6, C3, 80, 7C, FE, 3A, 75,    7A1
960 DATA  5, C6, 44, FE,  8, C3, C6, 44, FF,  0, C3, 8B, 3E, 61,  1, 8B,    747
970 DATA 7D,  1, 3A, 75,  C, BA, 15, 80, EA, 41, B4,  E, CD, 21, 83, C7,    67D
980 DATA  2, 57, 8B, DF, 32, C0, B9, 80,  0, FC, F2, AE, 8D, 75, FF, B9,    944
990 DATA  0,  0, 3B, F3, 74, 37, 4E, 80, 3C, 5C, 74,  7, 41, 3B, F3, 74,    59D
1000 DATA  3, EB, F3, 46,  B, C9, 74, 25, 83, F9,  C, 77, 26, 56, BF, B7,    785
1010 DATA  7, 41, F3, A4, 5E, 5F, 3B, F3, 74, 1F, 43, 3B, F3, 74,  1, 4E,    691
1020 DATA C6,  4,  0, 88, D7, B4, 3B, CD, 21, 73,  E, EB,  6, BA, F7,  1,    72D
1030 DATA E8,  1, FF, BA, C7,  1, E8, FB, FE, C3, 58, 53, 52, 57, BF, C0,    9E1
1040 DATA  F, AC, 3C,  9, 75, 1A, A1, 71,  7, 48, 33, D2, 8B, 1E, 67,  1,    586
1050 DATA F7, F3, 2B, DA, 80, 20, AA, FF,  6, 71,  7, 4B, 75, F8, EB, 2C,    8BD
1060 DATA 3C,  D, 74,  4, 3C,  C, 75,  8, C7,  6, 71,  7,  8,  0, EB, 13,    3C9
1070 DATA 3C,  8, 75,  F, AA, FF,  E, 71,  7, 75, 11, C7,  6, 71,  7,  1,    4C3
1080 DATA  8, EB,  9, AA, 3C,  A, 74,  4, FF,  6, 71,  7, E2, B3, BE, C0,    6F4
1090 DATA  F, 8B, CF, 2B, CE, 5F, 5A, 5B, 58, C3, E3, 11, 80, 3E, 69,  1,    6AD
1100 DATA  1, 75,  3, E8, 26,  0, E8, C6,  8,  3, D1, 33, C9, C3, 58, 53,    665
1110 DATA 57, A1, 6F,  7, B9,  4,  0, B3, 28, BF, BC,  1, E8, F1,  8, BA,    78D
1120 DATA 6B,  1, B9, 5C,  0, E8, A1,  0, 5F, 5B, 58, C3, 53, 51, 52, F7,    6CC
1130 DATA  6, 6F,  7,  1,  0, 74, 21, BA, A6,  2, B9, 15,  8, E8, 89,  8,    4B3
1140 DATA BB, 42,  0, B9,  3,  0, BA, BB,  2, E8, 7D,  0, 4B, 75, FA, BA,    709
1150 DATA BE,  2, B9, 13,  8, EB,  7, 90, BA, D1,  2, B9, 12,  0, E8, 68,    6B6
1160 DATA  0, C7,  6, 73,  7,  1,  0, C6,  6, 69,  1,  0, FF,  6, 6F,  7,    3F9
1170 DATA E8, 9B, FF, 5A, 59, 5B, C3, FF,  6, 73,  7, 83, 3E, 73,  7, 42,    74F
1180 DATA 7E,  5, C6,  6, 69,  1,  1, C3, 51, 52, BA, 6C,  2, B9, 37,  8,    538
1190 DATA E8, 36,  0, C7,  6, 6F,  7,  1,  0, C7,  6, 71,  7,  1,  0, C7,    467
1200 DATA  6, 73,  7,  1,  0, C6,  6, 6A,  1,  1, C6,  6, C7,  F,  8, 98,    3EB
1210 DATA E8, 5B, FF, 5A, 59, C3, 51, 52, BA, A3,  2, B9,  3,  0, E8,  0,    766
1220 DATA  0, C6,  6, 6A,  1,  0, 5A, 59, C3, 50, 53, B4, 40, BB, 1E, 65,    552
1230 DATA  1, CD, 21, 5B, 58, C3, 56, 57, BE, 81,  8, 8B, FE, FC, AC, 3C,    7BE
1240 DATA  0, 74,  D, 3C, 61, 72,  6, 3C, 7A, 77,  2, 2C, 20, AA, EB, EE,    5A1
1250 DATA 5F, 5E, C3, 33, C8, 88, 3C, 30, 72, 15, 80, 3C, 39, 77, 10, 32,    594
1260 DATA E4, B3,  A, F6, E3, 8A, 1C, 88, E3,  F,  2, C3, 46, EB, E6, C3,    931
1270 DATA 50, 53, 51, 52, 57, 9C, FD,  3, F9, 4F, 53, BB, A,  0,  B, C8,    664
1280 DATA 74, 11, 33, D2, F7, F3, 8B, CA, 30, 88, 15, 4F, 49, 75, EF, 5B,    7BA
1290 DATA EB,  6, 90, 58, AA, 49, 75, FC, 9D, 5F, 5A, 59, 5B, 58, C3,  0,    762
1300 DATA 155026
```

LASERLST.BAS: *This BASIC program will automatically create LASERLST.COM when you run it once.*

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■ UTILITIES

is used to print listings of program files, "readme" files, and the like, so the lack of word-wrap provisions is immaterial. LASERLST won't choke on lines longer than 81 characters; they just won't look as nice as you'd like.

Third, the tab characters in the text file will be replaced with spaces in the printout. If a tab is followed by one or more backspaces, each backspace will back up over only one of the tab-created spaces. Since LASERLST honors carriage-return and backspace codes individually, they can be used to overprint characters for such effects as underlining and strikeover.

HOW LASERLST WORKS The LASERLST program has three sections: command-line parsing, input-file I/O, and printer-state management. The code shown in LASERLST.ASM is heavily commented, so look there for details, but I'll touch on some of the highlights.

On entry, LASERLST checks the command-line parameters and simply aborts if they're bad. Next, it determines if the output file can be opened and whether any of the specified input files exist. If they do, each file is opened and read and its contents are passed to the print routine. When the end of the current file is read, the output file is not closed, though the print routine is informed that the end of file was encountered. That way, the print routine can return to its initial state, ready to print page 1 of the next file. When the last file is finished, control is returned to DOS.

■ LASERLST has three sections: command-line parsing, input-file I/O, and printer-state management.

Before command-line parsing starts, the current drive and directory are saved so they can be restored before returning to DOS. Next, the first argument is searched to see if a drive or path was specified. If so, the current drive and directory are changed to it. The reason for the change is that the DOS FIND FIRST and FIND NEXT MATCHING FILE calls return only the name of the file found. In order to open the named file it is necessary either to note the directory passed on the command line and append each filename found to it or, more simply, to be in that directory, where you can open the file just by passing the filename.

Determining whether a drive was specified on the command line is as easy as



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checking to see if the second character is a colon (:). Determining the path specified is a little more difficult, since the path runs from the character after the drive (if specified) through the last backslash (\) found. A REPNE SCASB instruction is used, starting from the end of the parameter, with the CPU's direction flag off. This causes a right-to-left search. If the final backslash is found, it is replaced by an ASCII zero to be passed to the DOS CHANGE CURRENT DIRECTORY call.

An interesting point to note in passing is that DOS will not open a file whose name ends in a colon, as would a user-supplied *outfile* of LPT2:. LASERLST fixes this by noting the colon at the end of the file specification and changing it to a null.

The input file processing is rather unremarkable except for one minor point. The DOS FIND FIRST function, which finds the first matching file to print, is used at initialization time and serves the dual purpose of initializing the FIND FIRST/FIND NEXT process and of determining if there are any files to print. The FIND NEXT is then performed directly after the close of each file, determining whether there are any more files to process.

■ The real meat of LASERLST is in its print routine, which maintains the current state of the printer.

The real meat of LASERLST is in its print routine. This routine maintains the current state of the printer, which includes the "printhead" position, the line currently being printed, and which side of the page is being composed. As each buffer of the file is read, it is passed to the PRINT routine. If it's the first buffer of a file, the initialization code in the routine PROLOGUE is executed, which writes an initialization string to the output file and initializes the print-routine state.

Any tabs in the buffer are then expanded into an appropriate number of spaces. Oddly enough, this is what accounts for the program's maximum memory requirement. Since LASERLST completely expands each 2K buffer read and the maximum tab width is 16, if someone were to pass LASERLST 2K worth of tab characters with /T16 specified, it would require 32K to expand it to blank spaces. The program itself requires about 4K between its .COM size and the uninitialized data area. Added to the 32K for an all-tabs buffer,



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this yields a 36K memory requirement. Figure 2 shows the memory layout at runtime.

After the tab expansion, each character is examined to see whether it will have a special impact on the printout. The special characters noted are carriage return, line feed, form feed, backspace, and character 82, on any given line. In explaining how LASERLST handles these characters, I'll use the conventional terms "printhead" and "paper movement." While there is no actual printhead in a laser printer, it's still the best term to use in describing how the program regards the position in the current line. Similarly, paper movement accurately describes how the LASERLST program regards moving "down" each page as it is printed.

A carriage return causes the printhead to move to the first character on the current line. No paper movement is caused by a carriage return.

The line feed causes the paper to move up a line, but does not cause the printhead to move. Thus, for example, if the printhead is at column 10 on line 3 when a line feed is encountered, the next character will be printed in column 10 of line 4. This is important because it also means that only 71 characters will be available on line 4 before the line wraps.

A form-feed character causes the print-

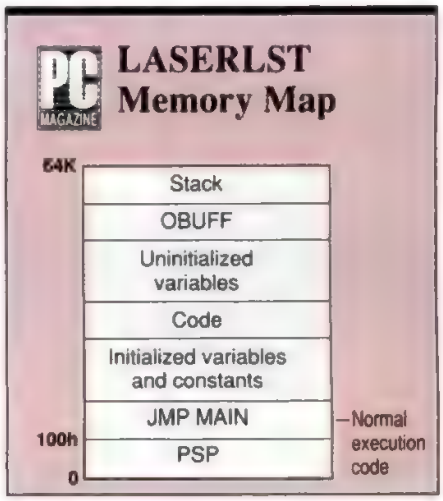


Figure 2: *With this memory layout, only the memory that starts at the first byte of the JMP MAIN (100h) instruction and the end of the code area must be saved in the LASER ST.COM file.*

■ PC MAGAZINE'S FREE UTILITY: A SUMMARY

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Tear out and hole-punch the command summary on this page and add it to your DOS manual.

LASERLST Command

Michael Holmes and Bob Flanders April 11, 1989 (Utilities)

Purpose: Formats text files so that the information of two standard-sized pages is printed side by side on a single landscape-mode page when printed with an HP LaserJet (or compatible) laser printer.

Format: **`[d:][path]LASERLST infile [outfile] [/Tn]`**

Remarks: The *infile* parameter designates the text file(s) to be printed. DOS "wildcards" (* and ?) can be used to designate multiple files, and a drive and path may also be included as part of *infile*.

By default, LASERLST sends its output to the standard DOS printing device, which is normally LPT1:. The optional *outfile* parameter can be used to direct the output either to another DOS device (LPT2:, for example), or to a disk file instead. The optional /T*n* switch causes each tab character (ASCII 9) in the *infile* to be replaced in the *outfile* with *n* spaces. The default value of *n* is 8; other values up to 16 may be used.

The *outfile* produced by LASERLST contains the requisite formatting and printing escape sequences used by the HP LaserJet printers. The *infile* is printed in landscape mode with two 66-line by 81-character pages on each physical page. Files suitable for processing by LASERLST should be ASCII files that do not contain escape sequences of their own and do not require any specific word processor's formatting codes. LASERLST does, however, support underlining produced by a backspace and character strikeover. LASERLST may be used with files whose line lengths exceed 81 characters, but lines will be wrapped automatically at their 82nd character, and no provision is made for word wrap. LASERLST is especially suitable for printing program listings, README files, and rough drafts of text to be edited.

Available for downloading from PC MagNet (see the sidebar "LASERLST by Modem" , LASERLST.COM is already compiled and ready to run. Alternatively, LASERLST.COM can be created from either of two program files, both printed in the article and available for downloading from PC MagNet. LASERLST.BAS will automatically create LASERLST.COM when you run it once in BASIC. Creating LASERLST.COM from the LASERLST.ASM source code requires the use of a macro assembler (IBM or Microsoft, Version 2 or later) and the following commands:

```
MASM LASERLST;
LINK LASERLST;
EXE2BIN LASERLST LASERLST.COM;
```

Commands

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er to go to the start of the next page. This character is not directly sent to the printer, however, but is intercepted so that the program can shift the printhead from an odd-numbered page to an even-numbered page without causing the printer to print and eject the sheet. Only when a form feed (or end of page) is encountered on an even-numbered page is an actual form-feed character sent to the printer to signal the start of the next physical page. It's interesting to note that, whether maintained in ASCII or binary, the last bit in the page number can be tested to determine which side of the page is being completed.

The only other character interpreted by the program is the printable character that would occupy the 82nd position in the line. Any such character causes a carriage return–line feed sequence to be output before the character itself, creating a line wrap.

The backspace character moves the printhead one character to the left, causing an overprint of the previous character.

When the end of file is encountered, PRINT is called with a parameter that tells it there is no more data. At this point, the EPILOGUE routine is called to finish printing the current file and reset the printer routine to its initial state for the start of the next file, if one is found.

LASER PRINTER INTERFACE Although the output may be saved as a DOS file, the ultimate target, of course, is the laser printer. LASERLST must embed the proper codes—escape sequences—in the *outfile* to tell the printer how to print the data. There are several rules that govern how the printer regards those sequences.

First, the printer looks for the ESCAPE character (27 decimal, 01B hex) as the start of any commands directed to it. With a versatile printer such as the HP LaserJet, escape sequences can command a wide range of actions. The commands used by LASERLST are explained in Figure 3.

The specific characters that follow the ESCAPE tell the printer which functions to perform, of course. You will note that each sequence ends in a capital letter. This is because Hewlett-Packard's printer language permits several commands to be combined in a single string. In the sequence

```
&a0r90m88L
```

there are actually three commands. When lowercase letters are used (for instance the *r* and *m* in the above string), the printer knows that another command sequence immediately follows. While this is clearly noted in the technical documentation for the printer, it may be overlooked when reading a program such as LASERLST, whose command sequences are simple and broken up.

While it is not very useful for those with dot matrix printers, if you have access to a laser printer, you'll find LASERLST to be a reasonably speedy program that prints certain types of files in a very readable format. And just think of the trees you'll save.

Michael Holmes is vice-president and senior systems analyst and Bob Flanders is president and senior systems analyst at NCI Systems Inc. in Annandale, Virginia.

Laser Printer Command Strings

&l1O	This string puts the printer in *landscape* mode, which causes it to print across the 11-inch length of the page rather than the 8½-inch width. The normal mode is known as *portrait* mode.
E	The ESC E sequence causes the printer to be reset to its power-up setup values. This sequence is sent at the beginning and end of each file printed.
(s17H	This sets the *font pitch* to 17 characters per inch, which permits a full 162 characters to be printed with enough left over for the border and separator lines.
&l5.14C	This escape sequence sets the *vertical motion index*, the amount of space the printer puts between the top of one line and the top of the next. The value 5.14 is the number of 1/48-inch increments to be used for each line. This translates into .1071 inch per line or 79 lines per page.
&l71F	This sets the *text length*, the maximum number of lines that may be printed before the printer will automatically eject the current page. In LASERLST, the page is not ejected, because the program relocates the cursor before the end of page is encountered.
&l6E	This sets the *top margin*, the area above the title line.
(s-3B	This sets the *stroke weight*, which tells the printer how bold the characters should be.
&a0R	This command causes the next position on the page to be the top printable line on the page.
&a5L **&a88L** **&a91L**	These commands tell the printer where to put the left margin. It is set to 5 during the left-hand page print, to 88 for printing the separator bar, and to 91 during the right-hand page print.
&a85M **&a90M** **&a171M**	These commands tell the printer where to put the right margin. It is set to 85 during left-side print, to 90 while printing the vertical bar, and to 171 during right-hand print. Note that the right margin set always occurs before the left margin set because the printer will not allow the left margin to be set beyond the right margin.
&dD	This command turns on underline mode.
&d@	This command turns off underline mode.

Figure 3: *The command strings used by LASERLST. Each string begins with the escape character, but only the characters following the escape are shown.*

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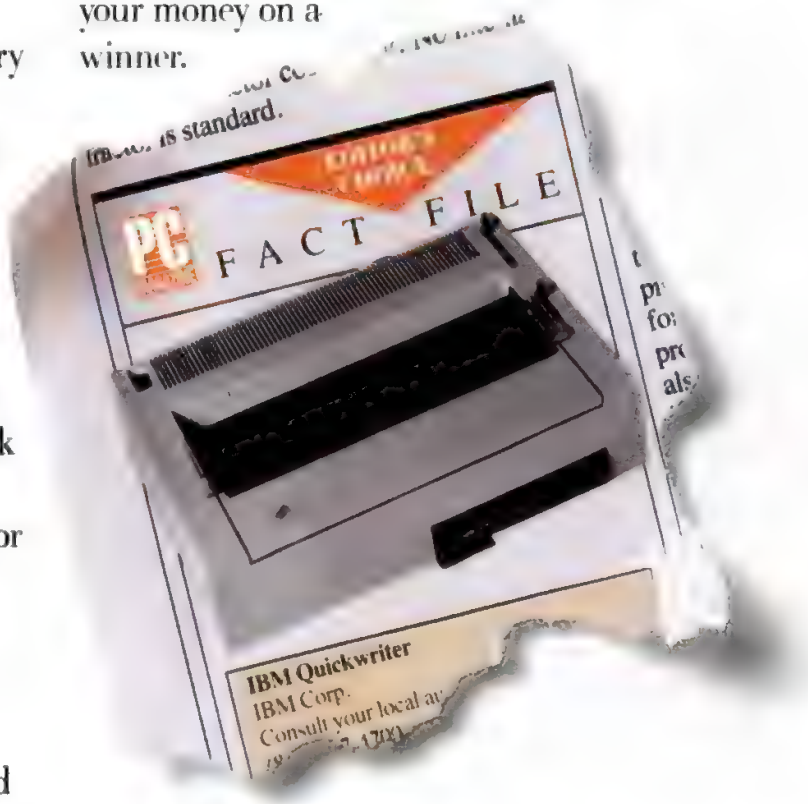
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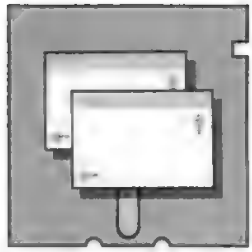
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■ ENVIRONMENTS ■ CHARLES PETZOLD

HOW TO MOVE THE TIMELINE WINDOW



Continuing to explore ways of using nonstandard windows in Presentation Manager programs, we'll see how easily you can add your own moving logic to TIMELINE.

In the last issue, I presented a somewhat unusual Presentation Manager program called TIMELINE, which displayed the date and time in the lower-left corner of the screen. The unusual thing about the program was that it omitted all the child windows normally found in PM programs. This let you see for yourself that the child windows—the title bar, system menu, and minimize/maximize buttons (as well as the sizing border displayed by the frame window)—are programmers' *options* rather than requirements.

Of course, the functionality of TIMELINE was consequently reduced. Without a sizing border or minimize/maximize buttons, TIMELINE cannot be resized or minimized. But since TIMELINE was designed as a fixed-size window, these features are not missed.

Playing with it myself, however, I decided that the absence of the title bar was a more-serious limitation. One of the purposes of the title bar is to allow a window to be moved around the screen. Lacking this, the TIMELINE window can't be moved. It just plunks itself down in the lower-left corner of the screen and refuses to budge. I suggested last time that TIMELINE could have included its own moving logic, even though it didn't. Some readers may have concluded that adding such a feature would be difficult.

Adding your own window-moving logic isn't really hard at all, however, and this column will show you how to do it. Moreover, the new version of TIMELINE will "remember" where it was last moved and automatically put itself there the next time you run the program. So if you'd prefer that TIMELINE sit in the lower-right corner of the screen (for example), you need only move it there once.

WHAT THE TITLE BAR DOES Normally, when you create a standard window for a Presentation Manager program, you include the FCF_TITLEBAR identifier among the frame-creation flags. This causes the Presentation Manager to create a title bar across the top of the window. The title bar serves several functions.

First, the title bar displays the name or title of the program. Programs that work with files (such as word processors) often use a title bar to display the name of the file being edited.

Second, the title bar changes color to indicate whether its program is the "active" window or not. The active window always appears on top of the other windows, and it receives any keyboard input.

■ The new date program will "remember" where it was last moved and automatically put itself there the next time you run the program.

Third, as I indicated, the title bar is responsible for supporting the movement of windows around the screen. The easiest way to move a window is to press button 1 on the mouse while the mouse pointer is positioned over the title bar. A rectangular frame (the same size as the window and as wide as the program's border) is then displayed. You simply move this frame by moving the mouse and when you release the mouse button the window moves to the new position.

You can also move the window by using the keyboard. You can select Move from the system menu or simply press Alt-F7. Again the rectangular frame is displayed and you can move it with the cursor movement keys. Pressing Enter ends the move operation; pressing Esc aborts it. Indeed, if you wish, you can even combine the keyboard and mouse when moving a window.

Now normally, of course, a program shouldn't attempt to draw anything outside its own window, since in doing so it could interfere with other programs that are displaying something on their windows. Yet the rectangular frame used for moving the window seemingly breaks this rule.

You'll notice, though, that when the rectangular frame is displayed, all other parts of the screen are frozen and cannot be updated. (For example, if you run the RANDRECT program, from the November 29, 1988, Environments column, you'll see it stop when you begin a moving operation.) It is this characteristic that allows the frame to be displayed and erased while it is being moved without affecting

■ ENVIRONMENTS

```
/*--------------------------------------------------------------------------
   TIMELINE.SUB -- Substitute window procedure and new function for TIMELINE
                   (c) 1989, Ziff Communications Co.
                   PC Magazine * Charles Petzold, November 1988
  --------------------------------------------------------------------------*/

BOOL MoveWindow (HWND hwndFrame, POINTL *pptlPosition, BOOL fKeyboard)
     {
     TRACKINFO ti ;

     WinQueryWindowRect (hwndFrame, &ti.rclTrack) ;
     WinMapWindowPoints (hwndFrame, HWND_DESKTOP, (PPOINTL) &ti.rclTrack, 2) ;

     ti.fs = TF_MOVE | TF_STANDARD | TF_ALLINBOUNDARY |
                       (fKeyboard ? TF_SETPOINTERPOS : 0) ;
     ti.cxBorder   = 1 ;
     ti.cyBorder   = 1 ;
     ti.cxKeyboard = 8 ;
     ti.cyKeyboard = 8 ;

     ti.ptlMinTrackSize.x = 0 ;
     ti.ptlMinTrackSize.y = 0 ;
     ti.ptlMaxTrackSize.x = ti.rclTrack.xRight - ti.rclTrack.xLeft ;
     ti.ptlMaxTrackSize.y = ti.rclTrack.yTop   - ti.rclTrack.yBottom ;

     ti.rclBoundary.xLeft   = 0 ;
     ti.rclBoundary.yBottom = 0 ;
     ti.rclBoundary.xRight  = WinQuerySysValue (HWND_DESKTOP, SV_CXSCREEN) ;
     ti.rclBoundary.yTop    = WinQuerySysValue (HWND_DESKTOP, SV_CYSCREEN) ;

     if (WinTrackRect (HWND_DESKTOP, NULL, &ti))
          {
          pptlPosition->x = ti.rclTrack.xLeft ;
          pptlPosition->y = ti.rclTrack.yBottom ;

          return TRUE ;
          }
     return FALSE ;
     }

MRESULT EXPENTRY ClientWndProc (HWND hwnd, USHORT msg, MPARAM mp1, MPARAM mp2)
     {
     static CHAR szAppName[] = "TIMELINE",
                 szKeyName[] = "POSITION" ;
     static HWND hwndFrame ;
     HPS         hps;
     POINTL      ptlPosition ;
     SHORT       sDataSize ;

     switch (msg)
          {
          case WM_CREATE:
               SizeWindow (hwnd) ;

               hwndFrame = WinQueryWindow (hwnd, QW_PARENT, FALSE) ;

               sDataSize = sizeof ptlPosition ;

               if (WinQueryProfileData (hab, szAppName, szKeyName,
                                        &ptlPosition, &sDataSize))

                    WinSetWindowPos (hwndFrame, NULL, (SHORT) ptlPosition.x,
                                                      (SHORT) ptlPosition.y,
                                     0, 0, SWP_MOVE) ;

               WinStartTimer (hab, hwnd, ID_TIMER, 1000) ;
               return 0 ;

          case WM_TIMER:
               hps = WinGetPS (hwnd) ;
               UpdateTime (hwnd, hps) ;

               WinReleasePS (hps) ;
               return 0 ;

          case WM_CHAR:
               if (!(CHARMSG(&msg)->fs & KC_VIRTUALKEY) ||
                   !(CHARMSG(&msg)->fs & KC_ALT)        ||
                   !(CHARMSG(&msg)->fs & KC_KEYUP)      ||
                     CHARMSG(&msg)->vkey != VK_F7)
                    break ;
                                        // fall through
          case WM_BUTTON1DOWN:
               WinSetActiveWindow (HWND_DESKTOP, hwnd) ;

               if (MoveWindow (hwndFrame, &ptlPosition, msg == WM_CHAR))
                    {
                    WinSetWindowPos (hwndFrame, NULL, (SHORT) ptlPosition.x,
                                                      (SHORT) ptlPosition.y,
                                     0, 0, SWP_MOVE) ;

                    WinWriteProfileData (hab, szAppName, szKeyName,
                                         &ptlPosition, sizeof ptlPosition) ;
                    }
               return 0 ;

          case WM_PAINT:
               hps = WinBeginPaint (hwnd, NULL, NULL) ;
               GpiErase (hps) ;

               UpdateTime (hwnd, hps) ;

               WinEndPaint (hps) ;
               return 0 ;

          case WM_DESTROY:
               WinStopTimer (hab, hwnd, ID_TIMER) ;
               return 0 ;
          }
     return WinDefWindowProc (hwnd, msg, mp1, mp2) ;
     }
```

Figure 1: *The two functions in TIMELINE.SUB replace the original ClientWndProc in last issue's TIMELINE.C to add the window-moving logic.*

the windows of other programs.

Obviously, the title bar has access to a very powerful mechanism here. But it's nothing that you can't implement for yourself. It's a function called WinTrackRect. The title bar uses this function when you move a window, and the frame window uses WinTrackRect when you resize the window. Thus, WinTrackRect looks like the perfect solution for adding move logic to TIMELINE.

THE NEW TIMELINE Figure 1 shows a listing called TIMELINE.SUB. To create the new version of the TIMELINE program, you remove the ClientWndProc function from the TIMELINE.C listing presented in last issue's Environments column and substitute the two functions in TIMELINE.SUB. You can then use the same TIMELINE Make file and TIMELINE.DEF module definition file shown last time to recompile the program.

The new version of TIMELINE is movable. Just press mouse button 1 while the mouse pointer is positioned over TIMELINE's window and the rectangular frame will be displayed. Move it with the mouse to another part of the screen and release the mouse button.

There is also a keyboard interface. If you don't have a mouse installed, bring up the Task Manager and select TIMELINE from the list of programs. This makes TIMELINE the active program and gives it the input focus. Now press Alt-F7 (the same key combination used for moving other windows) and move the window with the cursor movement keys. Press Enter when you're finished or Esc to cancel the move operation.

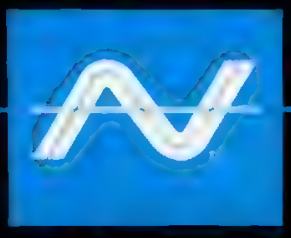
■ WinTrackRect freezes the window, displays the rectangular tracking frame, and allows it to be moved around the screen.

The new version of TIMELINE contains a slightly longer ClientWndProc and has one additional function, named MoveWindow. This function is called from ClientWndProc during processing of the WM_BUTTON1DOWN message. Naturally enough, that's the message that tells a program when the first button on the mouse has been pressed. In response to a WM_BUTTON1DOWN message, ClientWndProc calls WinSetActiveWindow to make TIMELINE the active window and then calls MoveWindow.

THE WinTrackRect FUNCTION The main job of MoveWindow is to call WinTrackRect. The WinTrackRect function freezes the window, displays the rectangular tracking frame, and allows the frame to be moved around the screen. The

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function returns when the user releases the mouse button or presses Enter or Esc.

A facility such as WinTrackRect must be versatile enough to be used for many purposes. As you can see from the listing, most of MoveWindow is devoted to setting up the fields of a TRACKINFO structure that is passed to the WinTrackRect function. This structure has 15 fields, including two that are POINTL (point) structures and two that are RECTL (rectangle) structures. Not all of them need be set for some uses of WinTrackRect.

The rclTrack field of the TRACKINFO structure is a RECTL structure that contains the initial size and position of the tracking rectangle relative to the lower-left corner of the screen. MoveWindow gets this information by calling WinQueryWindowRect, which returns the size and position of the frame window relative to the frame window's lower-left corner. It then translates this information into screen coordinates by calling WinMapWindowPoints. When WinTrackRect returns, the rclTrack structure contains the new size and position of the tracking rectangle.

The fs field of the TRACKINFO structure is a series of flags (encoded in a USHORT) that describe how WinTrackRect is to function. The most important flag in this case is TF_MOVE, which sets conditions so that the track rectangle retains the same size and can be moved around the screen.

The cxBorder and cyBorder fields of TRACKINFO contain the width of the rectangular frame that WinTrackRect draws. When you specify TF_STANDARD in the fs field, these dimensions are multiples of the standard border width. The cxKeyboard and cyKeyboard fields specify how many pixels the track rectangle moves for each cursor keypress.

The ptlMinTrackSize and ptlMaxTrackSize are really more important when you're using WinTrackRect for sizing rather than moving, but initializing them is still required.

The rclBoundary field is another RECTL structure. It specifies the limits within which the tracking rectangle can be moved. For the modified TIMELINE, I've allowed movement anywhere on the screen. The TF_ALLINBOUNDARY flag indicates that all of the tracking rectangle is to remain inside this boundary.

WinTrackRect returns TRUE if the tracking operation ended normally and FALSE if it was canceled by the user with the Esc key. If WinTrackRect returns TRUE, MoveWindow returns the new lower-left corner of the rclTrack structure to ClientWndProc by setting the fields of a POINTL structure pointed to by pptlPosition. If MoveWindow returns TRUE, then ClientWndProc uses WinSetWindowPos to set the window to the new position.

THE KEYBOARD INTERFACE Once this logic is in place, adding the keyboard interface (which uses the normal Alt-F7 key combination to initiate the move) is fairly simple. ClientWndProc processes WM_CHAR (keyboard) messages and checks if the key is a virtual key (that is, not a character key), if the Alt key is down, if the key is being released, and if the key is F7. If none of these conditions exist, then the WM_CHAR processing simply breaks. Otherwise, the WM_BUTTON1DOWN message is executed.

■ You can set system colors from the Presentation Manager Control Panel program.

There is one noteworthy difference between initiating the move operation with the mouse and with the keyboard. You'll notice that ClientWndProc sets the last parameter to MoveWindow to TRUE if the move operation originated from the keyboard and to FALSE if it originated from the mouse. If this parameter is TRUE, MoveWindow includes the TF_SETPOINTERPOS flag in the fs field of the TRACKINFO structure.

During the WinTrackRect call, the mouse pointer stays in the same position relative to the tracking rectangle. If you initiate the tracking from the mouse, is already positioned over the window, which is fine. But if a mouse is installed and you initiate the window move via the keyboard, the mouse pointer might be in some other part of the screen. It would look odd to see it move when you move the track rectangle. The TF_SETPOINTERPOS flag causes WinTrackRect to move the mouse pointer to the center of the rectangle when the tracking begins.

THE OS2.INI FILE As you probably know, you can set system colors and other preferences from the Presentation Manager Control Panel program. The Control Panel stores the values you select in a file called OS2.INI. (The extension of this file stands for "initialization" and is usually pronounced to rhyme with *skinny*.)

The OS2.INI file can be used by any other Presentation Manager program that needs to store and retrieve configuration or initialization information. Several functions are provided for this purpose.

Each entry in the OS2.INI file is identified by an application name (generally the .EXE filename without the extension) and a key name, which the program uses to identify the data. An application can use multiple key names to store items.

TIMELINE uses this facility to store the new position of the window and retrieve it the next time the program is run. The application name is TIMELINE and the key name is POSITION.

After setting the new window position during the WM_BUTTON1DOWN message, TIMELINE calls WinWriteProfileData to store the POINTL structure containing this position. (You'll notice a disk access whenever you move the window. This is the Presentation Manager writing the information to OS2.INI.)

During the WM_CREATE message, the program calls WinQueryProfileData to read in the values. If WinQueryProfileData cannot find the entry (which will be the case the first time the program is run) then the function returns FALSE. Only if the function returns TRUE does TIMELINE use the POINTL structure to set an initial window position.

In the DOS world, the use of configuration files is usually restricted to large programs because they can add a lot of overhead to small utilities. But the facility built into the PM is so easy to use that even simple programs like TIMELINE can store configuration information.

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EDITOR'S CHOICE

PC MAGAZINE

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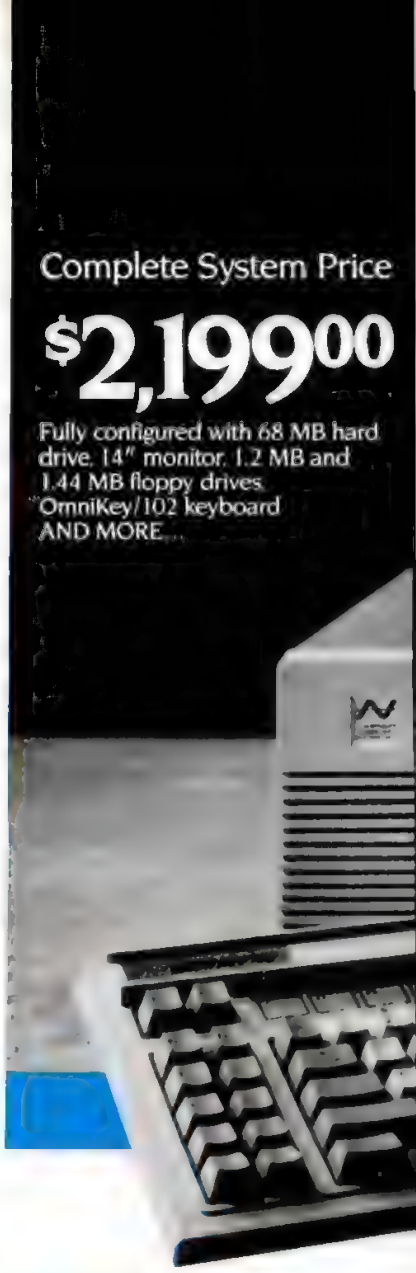
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PC MAGAZINE EDITORS' CHOICE

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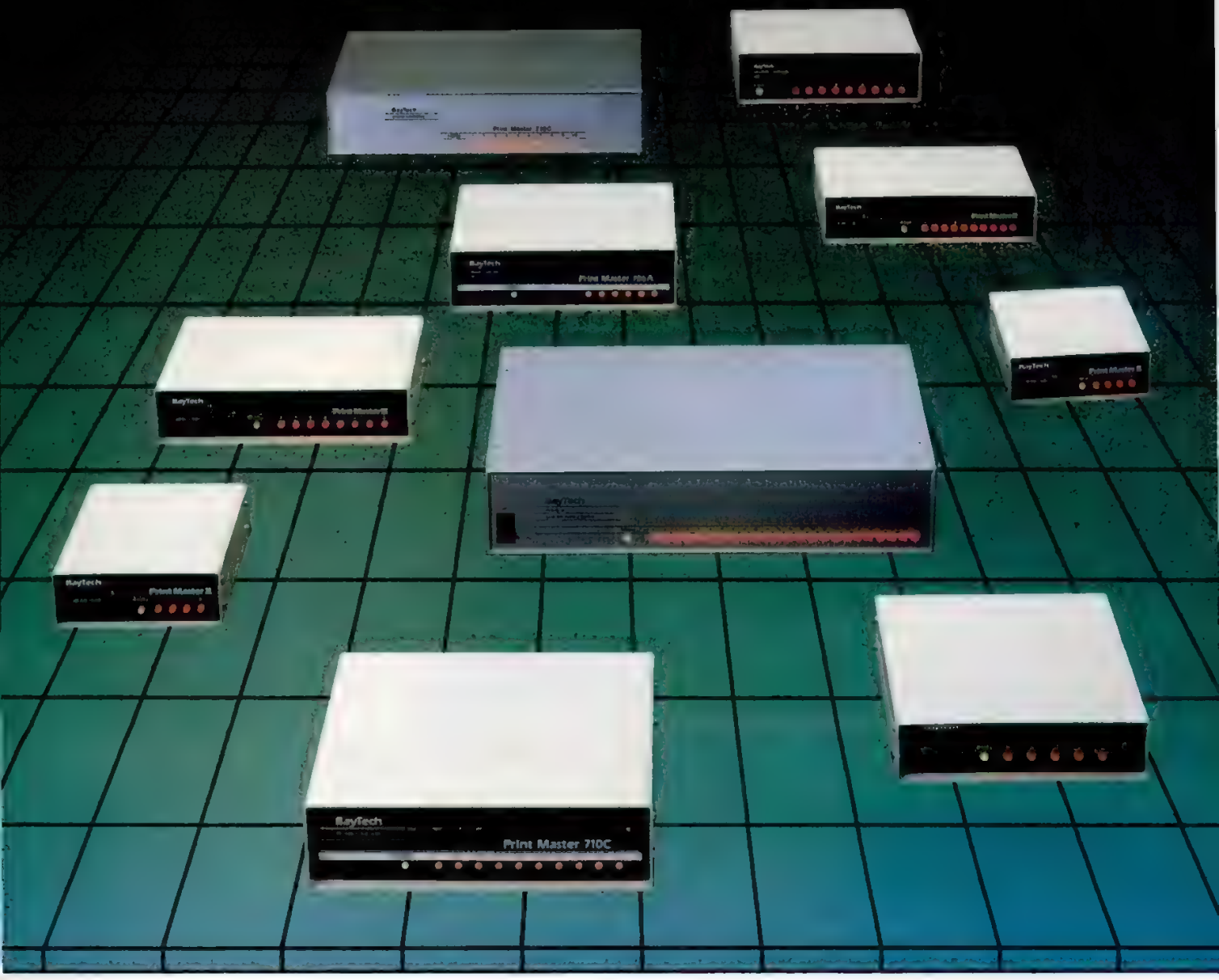
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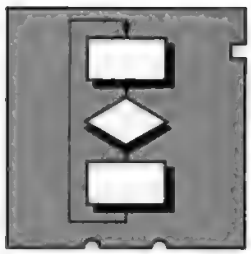
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AN INTRODUCTION TO INDEXED FILES



The pros and cons of different kinds of indexed files and file-index structures are explained, and two programs are included to let you experiment with the various techniques.

In the last two columns, we've briefly discussed sequential files and nonindexed random-access files. It's now time to take a look at indexed random-access files, the type most likely to be used by your favorite Brand X database program.

When information is stored in an indexed data file, the body of each data record is stored in a main file and an abbreviated form of the data, usually consisting of a *key* field and a record number or pointer, is stored in a separate *index file*. The key field is the element of a record that you will want to match when you search for the record later. Typically, the search key might be a customer name or account number. It's fairly common for a data set to be indexed on several different key fields, so that there are several index files associated with the same main data file.

When a program needs to locate a particular record, it first inspects the appropriate index file to try and locate the search key (name, account number, or other) for the record needed. If a matching index entry is found, the record number or position is extracted from the index and used to fetch the desired record from the main data file.

The basic premise of an indexed data file is simple. Because the index is only a subset of the entire data set, it is much smaller and can be searched much more rapidly. In fact, even when the main data file is many megabytes in size, it is usually possible to hold the entire index in memory at once. Moveover, within the index file, you can use special structures and techniques to maximize the speed of searches that would be impractical within the main data file.

ORGANIZING THE MAIN FILE In some simple databases, both the index file and the main file are kept sorted in the same order, as seen in Figure 1. This approach has several minor advantages. For one thing, because it does not need to contain any record numbers, the index file is quite compact. Instead, the position of a particular key in the index file directly indicates the position of the corresponding record in the main data file. Another advantage is that you can use the index file to find a particular starting record and then process records sequentially in the main file without further reference to the index.

The ordered-main-file approach also has some severe disadvantages. First, since the main file can be sorted only one way at a time, if you have several different indexes, you must decide which is to be the "primary" index. The subsidiary indexes must use a less-compact structure that includes record numbers.

More important, however, the ordered-main-file strategy brings with it all of the inconveniences of nonindexed ordered files that we discussed in the last column. Each time you add or delete a record, or update the key field in a record, you must move around a lot of other records in the main file as well as update the index file(s). This exacts a heavy price both in execution time and in the free disk space needed to carry out an update safely.

A more common and more efficient approach, then, is to decouple the order of

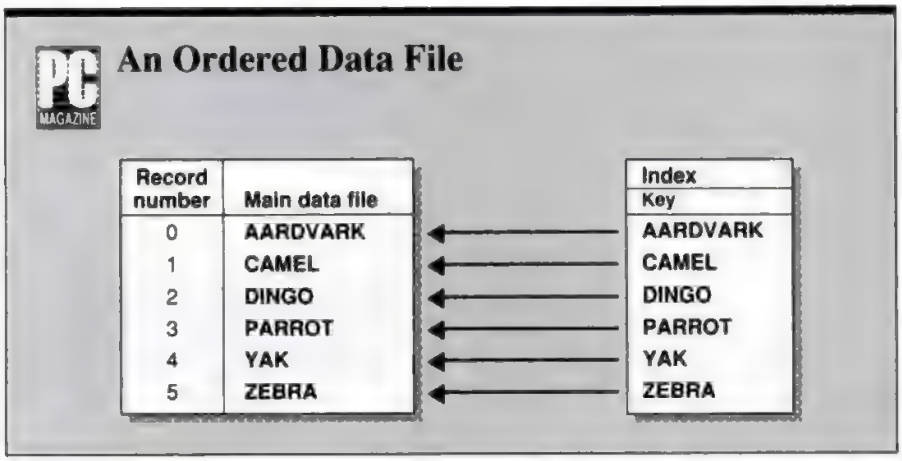


Figure 1: *A data file in the same order as its index file. While conceptually simple, this approach is very inefficient if the data is not static, since much data must be moved when records are added, deleted, or changed.*

the records in the main file from the order of the entries in the index files completely (Figure 2). This allows records to be added, deleted, or updated in the main file with a minimum of data movement. When a record is deleted, it is given a special key value that marks its position in the file as available. When a record is added to the file, it can be stuck into the first free position in the file or added to the end of the file if no available slots are found. The program that manages the database can update the indexes each time it adds or changes a record, or it can process a batch of records and then rebuild all of the indexes simultaneously.

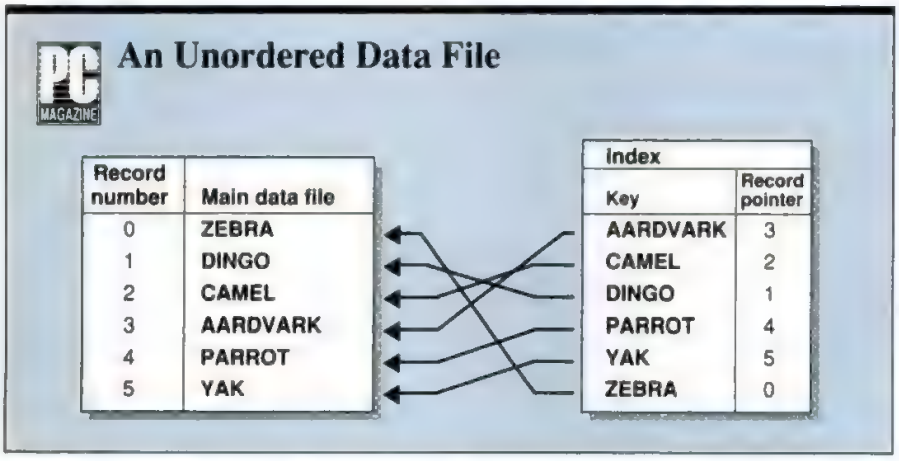


Figure 2: *An unordered data file with its index file. Because the data in the main file never needs to be moved, this is more efficient than the scheme shown in Figure 1. This is the simplest type of index file, with entries of uniform length, organized sequentially in order of key value, and associating each key with a record number or position in the main file.*

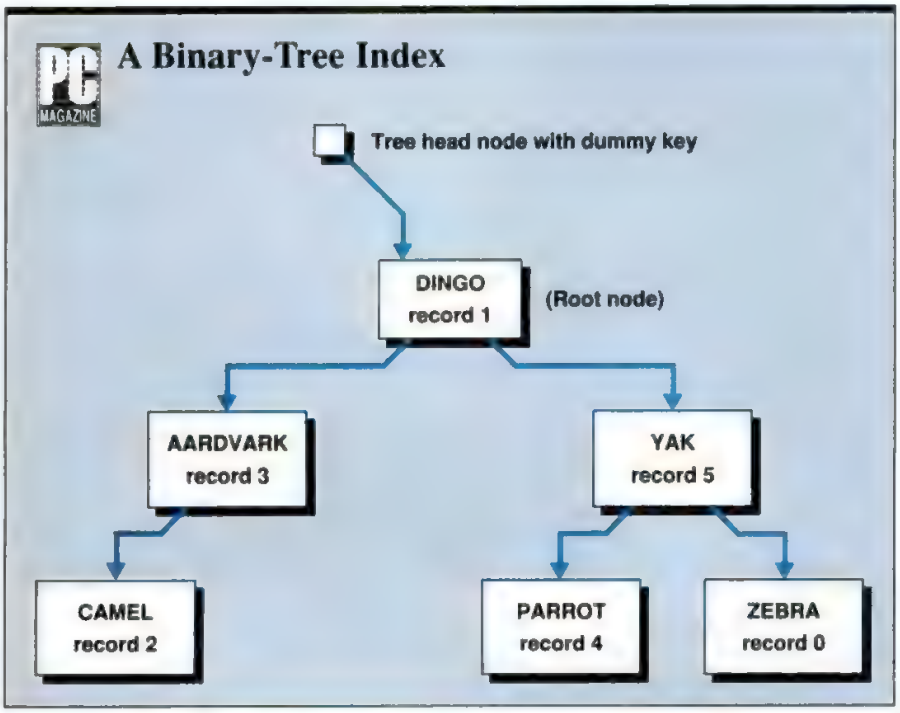


Figure 3: *A binary-tree index. The "root" node of the index contains the key for the first record that was added to the data file. Its linkages point to two subtrees: one holds the index entries for all records with lesser keys and the other indexes the records with greater keys.*

ORGANIZING THE INDEX FILE

Now let's peek inside the index file itself. The simplest form of index is just an abstract of the main data file, that is, a sorted list of keys associated with record numbers (see Figure 2). We can search such an index file in the same ways we used for the nonindexed files in the last column: either sequentially until the desired key is matched or excluded or with a binary search (assuming the index-file entries have a constant length).

Regardless of the search method, one drawback of such simple index files is that the search time is strongly dependent both on the contents of the index file itself and on the value of the key of interest. For example, if a binary search is used and the key values are not evenly distributed, the number of index entries which must be inspected to match a specific key may vary widely. And in real life, key values are seldom evenly distributed. Customer last names tend to begin with A, B, C, D, H, M, S, and W rather than Q and V, for example, and active account numbers tend to be heavily weighted toward the most-recently assigned number.

This is not a very desirable situation from the user's point of view. Naturally the user wants the search time for any given record to be as short as possible. But although he might not verbalize it, the user also wants search times to be *uniform*. He will get very aggravated if your program takes four times as long to find a name beginning with M as it does with a name beginning with E, or—if you do manage to convince him to live with nonuniform search times—if the search times don't vary in a "predictable" way.

Using a sequential or binary search of an index also complicates life when there can be multiple records with the same key value. In the case of the sequential search, after finding a match, you must keep reading index entries until you've found a mismatch. With the binary search, you may have to scan the index file for a mismatch in both directions from your original match to identify all the candidate records. This is worse than inelegant; it's inefficient, since you will always be obliged to inspect index records that are not matches.

Yet another drawback of such simple indexes is the amount of data movement

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involved in adding or deleting an index entry. Of course, it's much less work than moving the actual records around in the main file. Still, we'd like to reduce further—better yet, eliminate—the need for data movement altogether.

Over the years, the gods of computer science have come up with multiple answers to these problems. One of the most-commonly used solutions is to structure the index as a binary tree. In such a scheme, each entry in the index file is a node in the tree. The node consists of a key value, a record pointer into the main file, and a linkage to a "left" and "right" subtree (which might be a null link, if that subtree is empty). The first entry in the index file is the *root* of the binary tree; its "left" link points to the subtree containing all nodes with lesser keys, and the "right" link points to the subtree holding all nodes with greater keys.

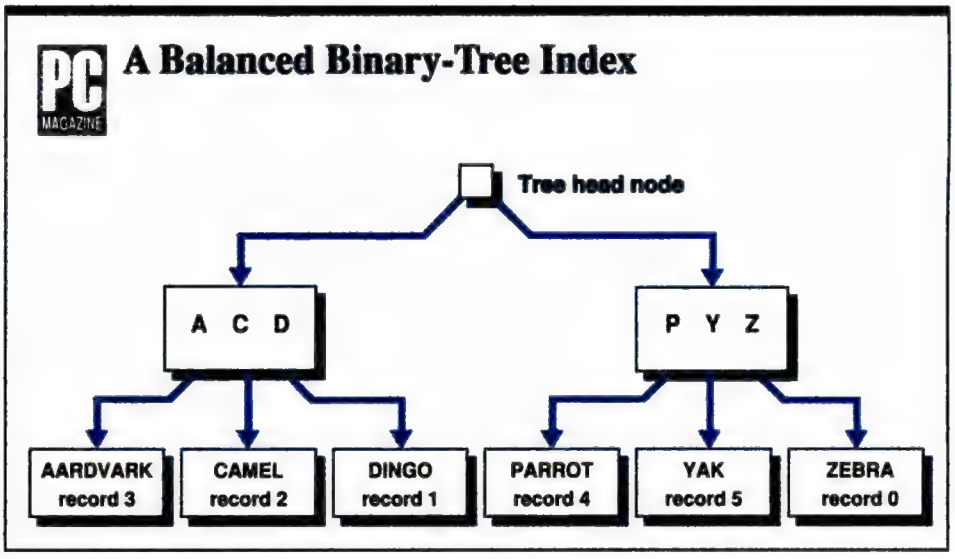


Figure 4: *A balanced binary-tree index. Although similar to the index in Figure 3, this tree contains two kinds of nodes:* internal nodes, *which only point to other nodes, and* external nodes, *which point to actual data records. In a balanced tree, the number of nodes that must be examined to find any particular index entry is a constant.*

```
/*
    MAKEIXF.C   Creates an indexed random access file for use by SRCHIXF.C
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    PC Magazine * Ray Duncan

    The user is prompted to enter from zero to one hundred
    ASCII strings.  These strings are used to build records
    in the main data file TESTFILE.DAT and two index files:
    TESTFILE.IX1, which is a simple sorted index containing
    keys and record numbers, and TESTFILE.IX2, which is a
    binary tree index.

    Each record in TESTFILE.DAT is RSIZE bytes long.  The
    format of the index files is defined by the constant
    KSIZE and by the structures 'index1' and 'index2'.
    All these manifest constants and structures must be kept
    synchronized with SRCHIXF.C.
*/

#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <fcntl.h>
#include <sys\types.h>
#include <sys\stat.h>
#include <io.h>

#define ISIZE   80                      /* max entry length */
#define N_ITEMS 100                     /* max number of strings */
#define RSIZE   64                      /* fixed record size */
#define KSIZE    8                      /* maximum key length */

char items[N_ITEMS * ISIZE];            /* original entries stored here */

struct _index1 {                        /* sorted sequential index */
      char key[KSIZE];
      int recno;
    } index1[N_ITEMS] ;

struct _index2 {                        /* binary tree index */
      char key[KSIZE];
      int recno;
      int left;
      int right;
    } index2[N_ITEMS + 1] ;

int getkeys(void);                      /* function prototypes */
void writedata(int);
void writeindex1(int);
void writeindex2(int);
void treeinsert(int, int);
void dumptree(int);

main()
{
    int i;                              /* number of record keys entered */

    i = getkeys();                      /* get record keys from user */
    writedata(i);                       /* write main data file */
    writeindex1(i);                     /* write sequential index */
    writeindex2(i);                     /* write binary tree index */
    dumptree(0);                        /* dump binary tree on screen */
}

/*
    Get record keys from user, leave them in array 'items',
    return number of keys to caller.
*/
int getkeys(void)
{
    int i, j;                           /* scratch variables */

    puts("\nEnter keys for file records...");

    i = 0;                              /* initialize string count */

    while(i < N_ITEMS)                  /* enforce maximum entries */
    {
        printf("%2d: ", i+1);           /* prompt user for next string */
        gets(&items[ISIZE * i]);        /* read keyboard, store in array */

                                        /* last entry if empty line */
        if(items[ISIZE * i] == 0) break;

        for(j = 0; j < i; j++)          /* make sure not duplicate key */
        {
            if(strncmp(&items[ISIZE * i], &items[ISIZE * j], KSIZE) == 0)
                break;                  /* exit loop if duplicate found */
        }

        if(i == j) i++;                 /* count non-duplicate strings */
        else puts("Duplicate key, try again.");
    }

    return (i);                         /* return no. of keys entered */
}

/*
    Create main data file TESTFILE.DAT, using strings stored
    in array 'items'.
*/
void writedata(recs)
{
    int i = 0;                          /* scratch variable */
    int fh;                             /* handle for output file */
    char recbuf[RSIZE];                 /* scratch record buffer */

                                        /* create main data file */
    fh = open("TESTFILE.DAT", O_WRONLY|O_CREAT|O_TRUNC|O_BINARY, S_IWRITE);

    if(fh == -1)                        /* terminate if create failed */
    {
        puts("\nCan't create TESTFILE.DAT.");
        exit(1);
    }

    puts("\nWriting TESTFILE.DAT...");

    while(i < recs)                     /* build and write records */
    {
        memset(recbuf, 0, RSIZE);
        strncpy(recbuf, &items[ISIZE * i], RSIZE);
        write(fh, recbuf, RSIZE);
        i++;
    }
```

(continues)

Figure 5: *MAKEIXF.C, a "test-bed" C program for creating an indexed data file based on ASCII keys entered by the user. The resulting files, named TESTFILE.DAT, TESTFILE.IX1, and TESTFILE.IX2, are used by the SRCHIXF program shown in Figure 6.*

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■ POWER PROGRAMMING

```
    close(fh);                          /* release file handle */
}

/*
    Create sequential index file TESTFILE.IX1, using strings stored
    in array 'items'.  The index is first built in the structure
    'index1' by copying each key to the structure and associating
    it with a record number.  The index is then sorted and written
    to disk.
*/
void writeindex1(recs)
{
    int i = 0;                          /* scratch variable */
    int fh;                             /* handle for index file */

    while(i < recs)                     /* build index entries */
    {
        strncpy(index1[i].key, &items[ISIZE * i], KSIZE);
        index1[i].recno = i;
        i++;
    }
                                        /* sort the index */
    if(recs != 0) qsort(&index1[0], recs, sizeof(index1[0]), strcmp);

                                        /* create sequential index file */
    fh = open("TESTFILE.IX1", O_WRONLY|O_CREAT|O_TRUNC|O_BINARY, S_IWRITE);

    if(fh == -1)                        /* terminate if create failed */
    {
        puts("\nCan't create TESTFILE.IX1.");
        exit(1);
    }

    puts("\nWriting TESTFILE.IX1...");

    for(i = 0; i < recs; i++)           /* write the index file */
        write(fh, (char *) &index1[i], sizeof(index1[0]));

    close(fh);                          /* release handle */
}

/*
    Create binary tree index file TESTFILE.IX2, using strings
    stored in array 'items'.  The keys are added into the tree
    in the order of their original entry, and are associated
    with a record number.  The index is then written to disk.
*/
void writeindex2(recs)
{
    int i = 0;                          /* scratch variable */
    int fh;                             /* handle for index file */

                                        /* initialize tree head */
    memset(&index2[0], 0, sizeof(index2[0]));   /* lowest possible key */
    index2[0].left = -1;                /* link = -1 indicates an */
    index2[0].right = -1;               /* empty subtree */

    while(i < recs)                     /* build binary tree */
    {
        treeinsert(i, i+1);             /* add new node for current string */
        i++;                            /* and count strings processed */
    }
                                        /* create file to hold binary tree */
    fh = open("TESTFILE.IX2", O_WRONLY|O_CREAT|O_TRUNC|O_BINARY, S_IWRITE);

    if(fh == -1)                        /* terminate if create failed */
    {
        puts("\nCan't create TESTFILE.IX2.");
        exit(1);
    }

    puts("\nWriting TESTFILE.IX2...");

    for(i = 0; i < recs+1; i++)         /* write tree, including head */
        write(fh, (char *) &index2[i], sizeof(index2[0]));

    close(fh);                          /* release handle */
}

/*
    Add a new node to the binary tree.  Procedure is called with an
    index to array 'items' (used to locate the key for the node
    being added and as the record number for TESTFILE.DAT) and the
    number of the next free node.
*/
void treeinsert(itemno, new)
{
    int i, j, node = 0;                 /* scratch variables */

    do                                  /* find tree insertion point */
    {
        i = node;                       /* save possible parent node */

                                        /* to choose subtree, compare this
                                           node to key being added */
        if((j = strncmp(&items[itemno * ISIZE], index2[node].key, KSIZE)) < 0)
            node = index2[node].left;
        else node = index2[node].right;

    } while (node != -1);               /* until empty subtree found */

    index2[new].left = -1;              /* build a new node; link = -1 */
    index2[new].right = -1;             /* indicates empty subtree */
    index2[new].recno = itemno;         /* record no. for main datafile */
    strncpy(index2[new].key, &items[itemno * ISIZE], KSIZE);

    if(j < 0) index2[i].left = new;     /* update parent node link field */
    else  index2[i].right = new;
}

/*
    Debugging routine to dump binary tree nodes in order of keys.
    This is just to demonstrate that we are writing a valid and
    correctly ordered tree and that there are no wild link fields.
*/
void dumptree(node)
{
    if(node != -1)                      /* ignore empty subtrees */
    {
        dumptree(index2[node].left);    /* display left subtree */

        if(node == 0) printf("\nContents of binary tree index:");
        else printf("\nNode = %2d, Record no. = %2d, Record key = %.8s",
                    node, index2[node].recno, index2[node].key);

        dumptree(index2[node].right);   /* display right subtree */
    }
}
```

(Figure 5 ends)

```
/*
    SRCHIXF.C   Searches indexed datafile previously created by MAKEIXF.EXE.
    Copyright (C) 1989 Ziff Communications Co.
    PC Magazine * Ray Duncan


    The user is prompted to enter a search key.  The first
    8 characters of the key are used to search the sorted
    index file TESTFILE.IX1 (using both sequential and binary
    search algorithms) and the binary tree index file
    TESTFILE.IX2.  If a match is found, the corresponding
    record number and contents from TESTFILE.DAT are displayed,
    along with the number of index inspections used by each
    method.

    Each record in TESTFILE.DAT is RSIZE bytes long.  The
    format of the index files is defined by the constant
    KSIZE and by the structures 'index1' and 'index2'.
    All these manifest constants and structures must be kept
    synchronized with MAKEIXF.C.
*/

#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <fcntl.h>
#include <sys\types.h>
#include <sys\stat.h>
#include <io.h>


#define RSIZE   64                      /* fixed record size */
#define KSIZE    8                      /* maximum key length */

static int inspected;                   /* index entries inspected counter */

struct _index1 {                        /* sorted sequential index */
      char key[KSIZE];
      int recno; } ;

struct _index2 {                        /* binary tree index */
      char key[KSIZE];
      int recno;
      int left;
      int right; } ;

int binsearch(int, char *, int, int);   /* function prototypes */
int seqsearch(int, char *);
int treesearch(int, char *);

main()
{
    int i;                              /* scratch variable */
    int fhdf, fhix1, fhix2;             /* file handles */
    long fsize;                         /* size of file in bytes */
    int frecs;                          /* number of records in file */
    char key[80];                       /* key entered by user */
    char rec[RSIZE];                    /* scratch record buffer */

                                        /* open all files */
    fhdf  = open("TESTFILE.DAT", O_RDONLY | O_BINARY);
    fhix1 = open("TESTFILE.IX1", O_RDONLY | O_BINARY);
    fhix2 = open("TESTFILE.IX2", O_RDONLY | O_BINARY);

    if((fhdf == -1) || (fhix1 == -1) || (fhix2 == -1))
    {
        puts("\nMissing data or index file.");
        exit(1);
    }

    fsize = lseek(fhdf, 0L, SEEK_END);  /* find file size */
    frecs = fsize / RSIZE;              /* calculate number of records */

    printf("\nTESTFILE.DAT contains %ld bytes, %d records.", fsize, frecs);

    while(1)
    {
        printf("\n\nEnter key: ");      /* prompt user and */
        gets(key);                      /* input record key */

        if(key[0] == 0) break;          /* terminate if empty line */

        if(strlen(key) > KSIZE)
            printf("\nWarning:  key truncated to %d characters.", KSIZE);

        inspected = 0;                  /* reset index entries counter */

                                        /* perform sequential search of
                                           TESTFILE.IX1, display results */
```

(continues)

Figure 6: *SRCHIXF.C, a C program that performs sequential, binary, and binary-tree searches on the indexed data file created by MAKEIXF.*

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A ☐ 1-10
B ☐ 11-20
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■ POWER PROGRAMMING

```
    printf("\nSequential search result:  ");
    if((i = seqsearch(fhix1, key)) == -1) printf("record not found,");
    else printf("record number is %d,", i);
    printf("  %d index entries inspected.", inspected);

    inspected = 0;                      /* reset index entries counter */

                                        /* perform binary search of
                                           TESTFILE.IX1, display results */
    printf("\nBinary search result:      ");
    if((i = binsearch(fhix1, key, 0, frecs-1)) == -1)
        printf("record not found,");
    else printf("record number is %d,", i);
    printf("  %d index entries inspected.", inspected);

    inspected = 0;                      /* reset index entries counter */

                                        /* perform binary tree search of
                                           TESTFILE.IX2, display results */
    printf("\nBinary tree result:        ");
    if((i = treesearch(fhix2, key)) == -1) printf("record not found,");
    else printf("record number is %d,", i);
    printf("  %d index entries inspected.", inspected);

    if(i != -1)                         /* fetch record from main data */
    {                                   /* file and display it */
        lseek(fhdf, (long) (i * RSIZE), SEEK_SET);
        read(fhdf, rec, RSIZE);
        printf("\nContents of record %2d:     %s", i, rec);
        }
    }

    close(fhdf);                        /* release file handles */
    close(fhix1);
    close(fhix2);
}

/*
    Search index file TESTFILE.IX1 sequentially to match the
    specified key.  Called with a file handle and key address.
    Returns the record number for TESTFILE.DAT if match found,
    or -1 to indicate no match.
*/
int seqsearch(int fh, char *kptr)
{
    int i;                              /* scratch variable */
    struct _index1 index1;              /* receives index file data */

    lseek(fh, 0L, SEEK_SET);            /* rewind to start of file */

                                        /* do until end of file found */
    while(read(fh, (char *) &index1, sizeof(index1)) != 0)
{
    inspected++;                        /* inspect index entry */
    i = strncmp(kptr, index1.key, KSIZE);

    if(i == 0)                          /* if matched, return record no. */
        return(index1.recno);
    else if(i < 0) break;               /* if record absent, end search */
}

return(-1);                             /* no match, return -1 */
}

/*
    Binary search of TESTFILE.IX1 to match the specified key.
    Called with a file handle, key address, and the first
    and last record numbers of the index file segment being
    inspected.  Returns the record number for TESTFILE.DAT
    if match found, or -1 to indicate no match.
*/
int binsearch(int fh, char *kptr, int left, int right)
{
    int i, j;                           /* scratch variables */
    struct _index1 index1;              /* receives index file data */

    if(left > right) return(-1);        /* end search if record absent */

    i = (left + right) / 2;             /* calculate record number */

    inspected++;                        /* inspect index entry */
    lseek(fh, (long) (i * sizeof(index1)), SEEK_SET);
    read(fh, (char *) &index1, sizeof(index1));
    j = strncmp(kptr, index1.key, KSIZE);

    if(j == 0) return(index1.recno);    /* if matched, return record no. */

                                        /* otherwise bisect file, recurse
                                           to inspect next record */
    if(j < 0) binsearch(fh, kptr, left, i-1);
    else      binsearch(fh, kptr, i+1, right);
}

/*
    Binary tree search of TESTFILE.IX2 to match the specified
    key.  Called with a file handle and key address.  Returns
    the record number for TESTFILE.DAT if match found,
    or -1 to indicate no match.
*/
int treesearch(int fh, char *kptr)
{
    int i;                              /* scratch variable */
    int node = 0;                       /* current node being inspected */
    struct _index2 index2;              /* receives index file data */

    while(node != -1)                   /* do until match or empty subtree */
    {
        inspected++;                    /* inspect index entry */
        lseek(fh, (long) (node * sizeof(index2)), SEEK_SET);
        read(fh, (char *) &index2, sizeof(index2));
        i = strncmp(kptr, index2.key, KSIZE);

        if(i == 0)                      /* if matched, return record no. */
            return(index2.recno);

        if(i < 0)                       /* else traverse tree */
             node = index2.left;
        else node = index2.right;
    }

    return(-1);                         /* no match, return -1 */

    }
```

(Figure 6 ends)

To find a particular key, the binary tree is traversed from the root, as shown in Figure 3. At each node the key is compared. If it doesn't match the node exactly, then—based on the result of the comparison—one branch or the other of the node's subtree is selected. This process, which is admirably suited to languages that support recursion, is continued until the key is matched or until an empty subtree is reached.

In such a binary-tree index, the physical order of the entries in the index file is irrelevant and the index is easy to update dynamically. When a new record is added to the main data file, a corresponding index node can be physically added at the end of the index file, after which its linkage fields and those of the node that will become its "parent" are updated. Very little work and almost no data movement are required. Similarly, nodes can be logically deleted from the tree merely by adjusting some linkages.

Simple binary trees can lead to difficulties, however. When keys are not well distributed or are added to the tree in a nonrandom fashion, the tree can become quite assymetrical. As with the binary search we've already discussed, this leads to wide variations in tree traversal times. The computer scientists' answer to this is the "balanced" tree (sometimes called a *B-tree*), in which all subtrees of the nodes at a particular tree level have the same length. Such a tree is shown in Figure 4.

■ In a binary-tree index, the physical order of the entries in the index file is irrelevant and the index is easy to update dynamically.

Balanced-tree indexes are implemented with two types of nodes rather than one. *Internal nodes* point only to other nodes, and *external nodes* point to the records actually being indexed. Internal nodes must be able to contain more than one key, and they can have multiple linkages to the next-lower level. Balanced trees are very widely used because of their excellent performance on worst-case key distributions. The creation and maintenance of balanced trees is a complex subject and far beyond the scope of this column, although we may return to it in a later installment. In the meantime, let me refer you to Chapters 15 and 18 of Robert Sedgewick's *Algorithms* for further details.

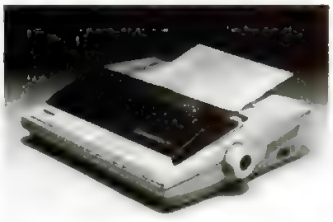
INDEXED FILE TEST-BEDS The two programs that accompany this column are test-beds that let you build small indexed files and then search them by several different methods.

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■ POWER PROGRAMMING

The first program, MAKEIXF.C (Figure 5), prompts you for up to 100 short ASCII strings. When you press Enter alone in response to a prompt, it creates a main data file named TESTFILE.DAT. The program then sorts the strings and creates two index files: TESTFILE.IX1 and TESTFILE.IX2. The main data file is arranged in the order that you entered the strings, so you can set up various worst-case situations. The first index file is a simple sorted list of keys and record numbers; the second is implemented as a binary tree.

The second program, SRCHIXF.C, is listed in Figure 6. It opens TESTFILE.DAT, TESTFILE.IX1, and TESTFILE.IX2, and prompts you for a key to search for. It then searches both index files and reports whether the record exists. If it does, SRCHIXF.C tells you how many keys had to be inspected by the sequential search, binary search, and tree search methods to find it.

■ Both MAKEIXF.C and SRCHIXF.C can be used in MS-DOS or OS/2 without any changes.

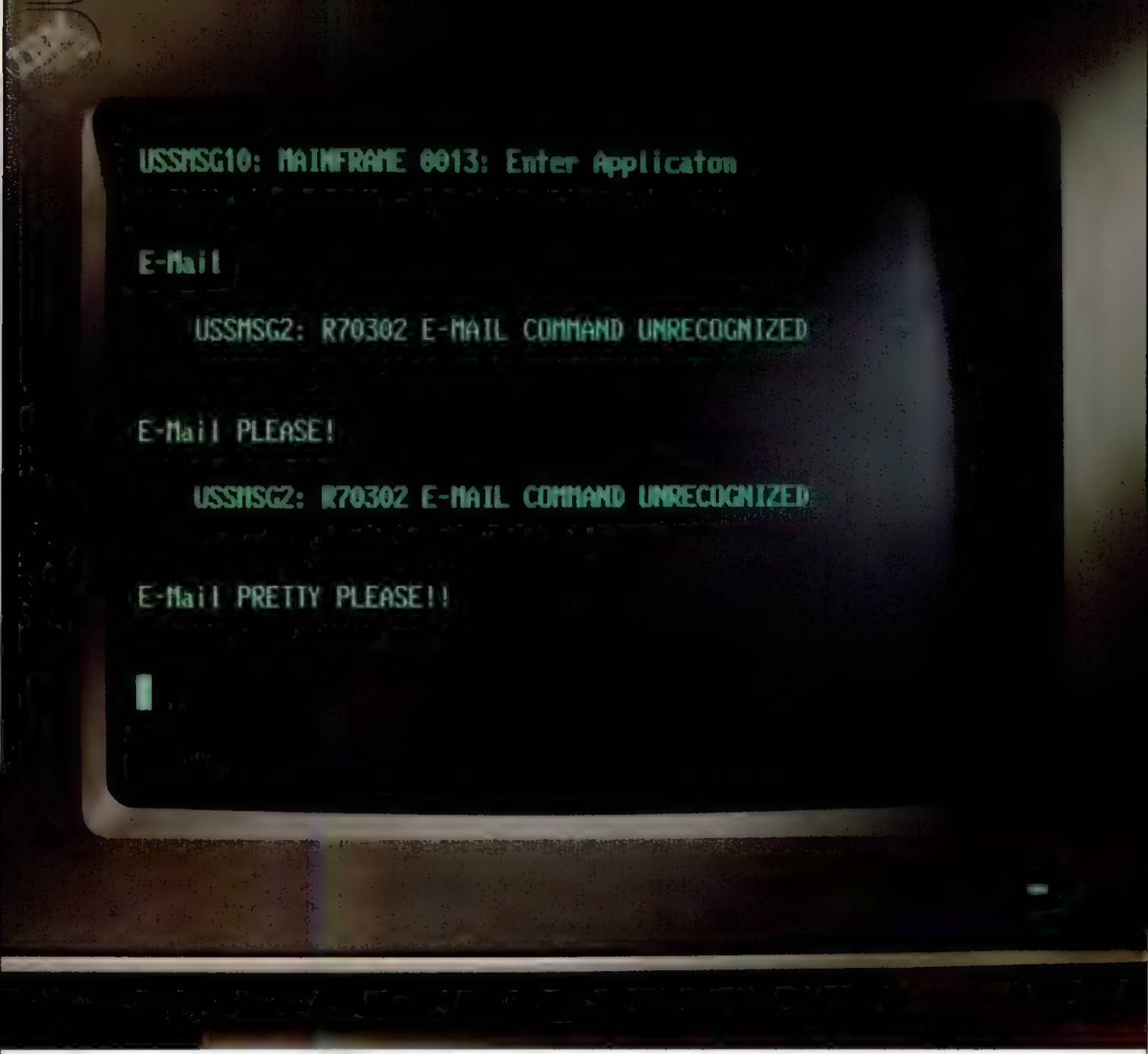
Both programs can be used under either MS-DOS or OS/2 without any changes. To compile the two programs, enter the commands

```
CL MAKEIXF.C
CL SRCHIXF.C
```

Run MAKEIXF.EXE first to create a data file, then run SRCHIXF.EXE to experiment with it. You are able to terminate SRCHIXF.EXE at any time by pressing Enter alone, Ctrl-C, or Ctrl-Break in response to a prompt.

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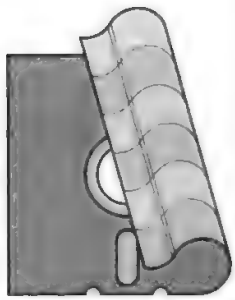
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SPREADSHEET CLINIC



Printing the current time in the header or footer of a 1-2-3 worksheet; entering values as unattached text in Excel can cause a problem; calculating time in a SuperCalc worksheet.

Adding hours, minutes, and seconds in a *SuperCalc* worksheet

I have found that I need to calculate the total of the hour, minute, and second entries in my *SuperCalc 4* worksheets. A simplified version of one of my worksheets is shown in Figure 1.

Cells B4:B8 contain values that represent whole numbers of hours; cells C4:C8 contain values that represent whole numbers of minutes; and cells D4:D8 have values that represent whole numbers of seconds.

To sum these values, I've used the formulas

```
B10:  SUM(B4:B8)+INT((SUM(C4:C8)+
        INT(SUM(D4:D8)/60))/60)
C10:  MOD(SUM(C4:C8)+INT(SUM(D4:D8)/60,60)
D10:  MOD(SUM(D4:D8),60)
```

in cells B10, C10, and D10, respectively. The formula in cell D10 calculates the number of seconds, above and beyond the number of whole minutes, represented by the sum of the second values in cells D4:D8. For example, the sum of the values in cells D4:D8 is 143. Since 143 seconds is 2 minutes and 23 seconds, this formula returns the value 23.

The formula in cell C10 calculates the number of minutes, above and beyond the number of whole hours, represented by the sum of the minute entries in cells C4:C8 plus the minute component of the sum of the second entries in cells D4:D8. In this case, the sum of entries in cells C4:C8 is 162; the minute component of the sum of the second entries in cells D4:D8 is 2. Since 162 plus 2 equals 164, and 164 minutes is equal to 2 hours and 44 minutes, the function in cell C10 returns the value 44.

In cell B10, the formula calculates the number of hours, above and beyond the number of whole minutes, represented by the sum of the hour entries in cells B4:B8 and the hour component of the sum of the minute entries in cells C4:C8 (including the minute component of the sum of the second values in cells D4:D8). Here, the sum of entries in cells B4:B8 is 97; the hour component of the sum of the minute entries in cells C4:C8 (including the minute component of the sum of the second values in cells D4:D8) is 2. Since 97 plus 2 equals 99, the function in cell B10 returns the value 99.—*Joseph Gonzalez; San Juan, Puerto Rico*

	A	B	C	D	E
1					
2		Hours	Minutes	Seconds	
3		-------	-------	-------	
4	Task 1	15	21	50	
5	Task 2	14	17	11	
6	Task 3	7	59	21	
7	Task 4	22	42	18	
8	Task 5	39	23	43	
9		-------	-------	-------	
10		99	44	23	
11					

Figure 1: *The formulas in cells B10, C10, and D10 of this worksheet calculate the total of the hour, minute, and second entries in cells B4 to D8.*

	A	B	C	D	E	F
1						
2		Days	Hours	Minutes	Seconds	
3		-------	-------	-------	-------	
4	Task 1	1	15	21	50	
5	Task 2	2	14	17	11	
6	Task 3	3	7	59	21	
7	Task 4	4	22	42	18	
8	Task 5	5	39	23	43	
9		-------	-------	-------	-------	
10		19	3	44	23	
11						

Figure 2: *The formulas in cells B10, C10, D10, and E10 of this worksheet calculate the sum of the days, hours, minutes, and seconds in cells B4 to E8.*

■ SPREADSHEET CLINIC

The technique described above will work in any spreadsheet program. If you want to, you can extend this technique to calculate days as well, as shown in Figure 2.

The formula in cell B10

```
B10:  SUM(B4:B8)+INT((SUM(C4:C8)+
      INT((SUM(D4:D8)+INT(SUM
      (E4:E8)/60))/60))/24)
```

calculates the number of whole days; the formula

```
C10:  MOD(SUM(C4:C8)+INT((SUM(D4:D8)+
      INT(SUM(E4:E8)/60))/60),24)
```

in cell C10 calculates the number of whole hours; and the formulas

```
D10:  MOD(SUM(D4:D8)+INT(SUM(E4:E8)/60,60)
E10:  MOD(SUM(E4:E8),60)
```

in cells D10 and E10 of the worksheet, calculate the number of whole minutes and seconds, respectively.

Excel modifies certain values entered in a chart as unattached text

I recently encountered a problem while I was adding unattached text to a chart that was created using the *Excel* program. When I entered the value 40,000 as unattached text for a chart, *Excel* converted that value into the string ="−25536". Figure 3 below shows the result.

Experimenting further, I discovered that this problem occurs with any value between 32,768 and 65,535, inclusive. Specifically, *Excel* subtracts values in this range from 65,536, multiplies the difference by −1, and displays the result in the chart.

Fortunately, you can circumvent this bug by entering the value in text form. For example, to display the characters 40,000 as unattached text, type ="40000". Then press the Enter key and *Excel* will convert the entry to 40,000, displaying this value in the chart.—*Jaime Castro; Atlanta, Georgia*

Apparently, *Excel* is storing values that are between 32,768 (32K) and 65,535 (one less than 64K) in short integer (16-bit) form, rather than in long integer (32-bit) form, as it should. Since the 16th bit in a 16-bit signed integer controls the sign of the value, the value 32,768 becomes −32,768; the value 32,769 becomes −32,767; the value 32,770 becomes −32,766; and so forth. *Excel* correctly stores values of 64K and greater in long integer form. Microsoft has corrected this problem in Version 2.1 of *Excel*.

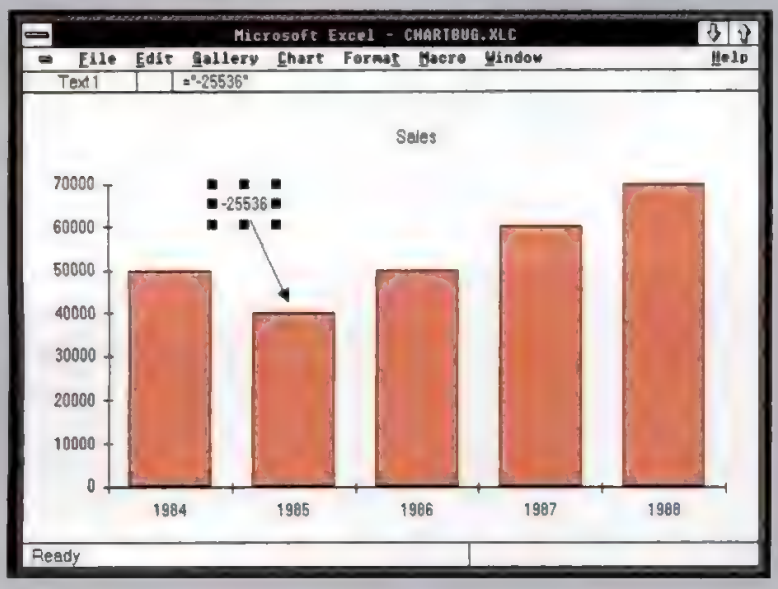


Figure 3: *If you enter a value between 32,768 and 65,535 as unattached text in a chart,* Excel *will subtract it from 65,536 and multiply the result by −1.*

How to print the current time at the top or bottom of *1-2-3* worksheets

The *Lotus 1-2-3* program lets you use the @ symbol to insert the current date into the header or footer of a printed worksheet. However, *1-2-3* fails to provide a symbol that inserts the current time into either of these structures. To put the current time into the header of a document, I have come up with the macro shown in Figure 4. You can easily modify this macro so that it inserts the current time into the footer as well.

The first statement in this macro enters the serial value of the current time into the cell named TIME (B7). Since this cell is assigned the Time 2 format, *1-2-3* will display that entry in hh:mm AM/PM form. Next, the macro tells *1-2-3* to issue the /Print Printer Options Header command and erase the current header (if there is one). The macro will then type the characters @| |.

The current header will not be erased if the area to the right of the "Enter Header Line:" prompt is blank. Instead, the {Esc} key will return *1-2-3* to the /Print Printer Options menu. However, typing a character—in this case the letter X—assures that this area won't be blank. The next three characters, @| |, specify a header that has the current date at its left edge, nothing in the middle of the page, and, at least to this point, nothing at the right edge of the page.

Before *1-2-3* presses the Enter key to lock in this header, it will execute this statement

```
B3:  '{Contents NEXT,TIME}
```

This instructs *1-2-3* to place a copy of what appears in the cell named TIME into the cell named NEXT (B4). For example, suppose that TIME contains the serial time value .75000. Because of the Time 2 format, this value will be displayed as `06:00 PM` in the worksheet. Since column B is nine characters wide, the {Contents} command will place the nine-character label `'06:00 PM` (note the single trailing space) into NEXT.

NEXT is the next cell in the macro, so *1-2-3* will now type the label that it just entered into NEXT. Since *1-2-3* has not yet

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■ SPREADSHEET CLINIC

```
      A          B          C          D          E
1   \t         {Let TIME,@NOW-@INT(@NOW)}
2              /ppohX{Esc}@||
3              {Contents NEXT,TIME}
4   NEXT
5              {BS}~qagq
6
7   TIME
8
```

Figure 4: *This macro inserts the current time into the footer of a* 1-2-3 *worksheet.*

```
      A          B          C          D          E          F          G
1   \t         {Let TIME,@NOW-@INT(@NOW)}
2              /ppohX{Esc}@||
3              {Contents NEXT,TIME,9,120}
4              {If @LEFT(NEXT,1)="0"}{Let NEXT,@MID(NEXT,1,8)}
5   NEXT
6              {BS}~qagq
7
8   TIME
9
```

Figure 5: *This macro is an alternative version of the one shown in Figure 4.*

pressed Enter to complete the /Print Printer Options Header command, the characters in that label will be appended to the end of the header. For example, if NEXT contained the label '06:00 PM at this point, *1-2-3* would type 06:00 PM to the right of the characters @ | |, creating the header @| | 06:00 PM.

Once the macro has added the current time to the header, it will evaluate the final statement in the macro. This commands *1-2-3* to lock in the header and quit from the Options menu. *1-2-3* will then print the worksheet and quit back to the READY mode.—*Marty Cuerdon; Castle Rock, Colorado*

This macro works well. *1-2-3* recalculates @NOW only a fraction of a second before it begins printing a report, so the time that appears at the top of a page is almost the exact time at which *1-2-3* begins printing. One drawback of this macro, however, is that since *1-2-3* does not "recalculate" the header prior to printing each page, the same time will appear at the top of every page of a report.

If you wish to do so, you can change this macro in any of the following ways: First, since combined date and time values appear in time form when assigned time formats, you can replace the argument of the {Let} statement in cell B1 with the function @NOW. Second, you can add the optional arguments 9 and 120 to the {Contents} command in cell B2. This way, the macro will work correctly no matter what format is assigned to TIME or how wide that cell is. Last, you can insert the statement

```
B4:  '{If @LEFT(NEXT,1)="0"}{Let NEXT,
     @MID(NEXT,1,8)}
```

between the statement in cell B3 and the cell named NEXT. This strips the leading 0 (if there is one) from the beginning of the label in NEXT. Figure 5 shows this revised macro.

Of course, you can use this same technique to enter the current time into a footer. To do this, you would simply replace the letter *h* within the statement in cell B2 with the letter *f*.

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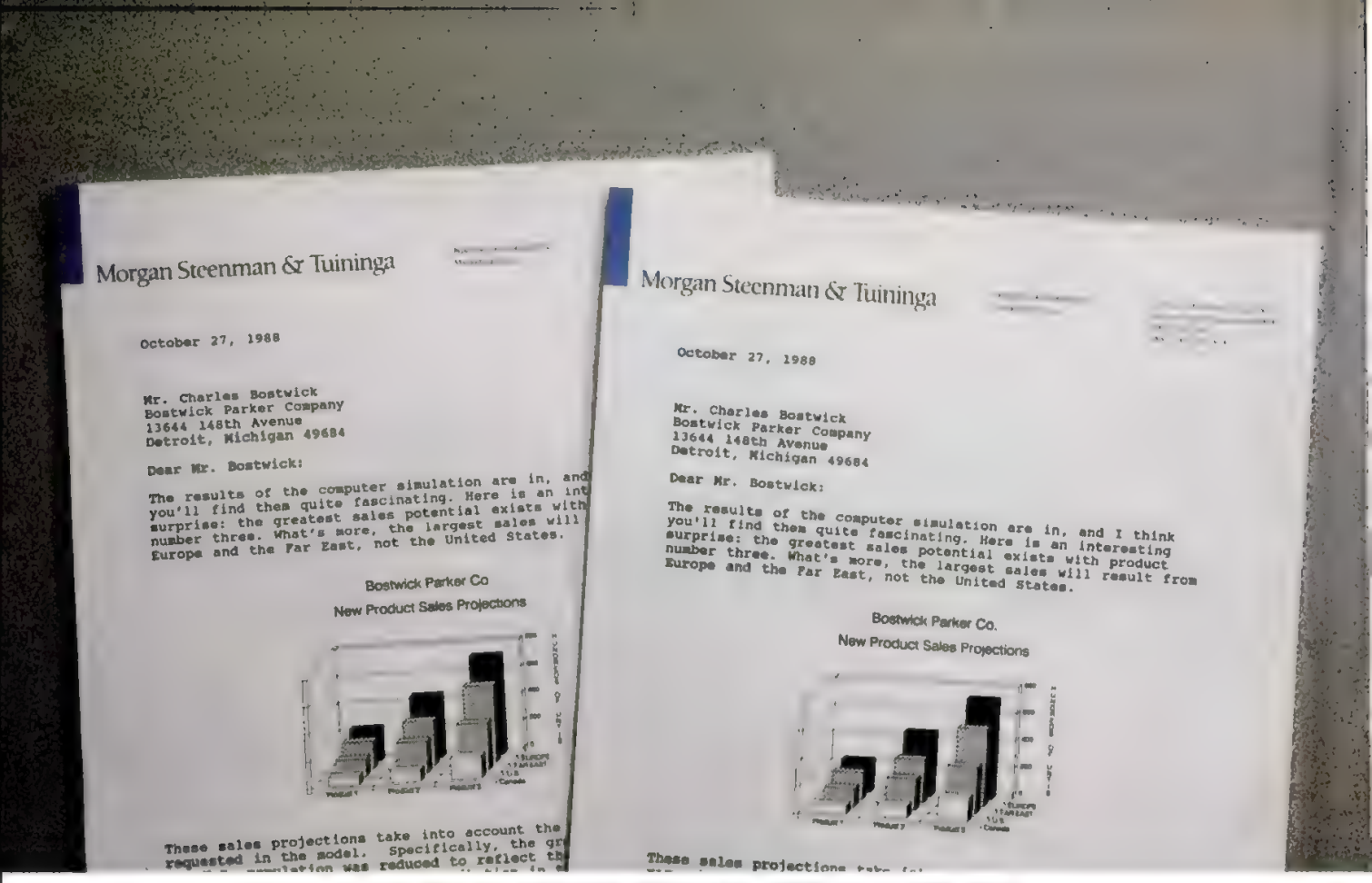
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CIRCLE 163 ON READER SERVICE CARD



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CIRCLE 726 ON READER SERVICE CARD

■ NEIL J. RUBENKING

USER-TO-USER



Maximize free memory with an alternative AUTOEXEC; display your computer's ID with a batch file; use ANSI escape sequences to create hard disk menus.

Track your bootups with an undocumented feature of CTTY

If you have an extensive AUTOEXEC .BAT file like I do, you are probably tired of seeing the same messages scroll past every time you boot your computer. Adding CTTY NULL to the beginning of your AUTOEXEC file would redirect console output and no messages would be sent to your screen. But this would also mean that you wouldn't see any error messages.

A better idea is to redirect the screen to a file that you can type out later. For example, to send all console output to the file AUTOEXEC.LOG, simply add

```
CTTY > AUTOEXEC.LOG
```

to the beginning of your AUTOEXEC .BAT file. Then if something does go wrong at boot time, you can use TYPE or a word processor to view the AUTOEXEC .LOG file. This is also great for those times when error messages flash by so fast that you don't have time to read them.

If you don't like a blank screen while booting, add

```
ECHO Please wait while system starts up
```

before CTTY > AUTOEXEC.LOG. This will let users know what is going on.

One final note, be sure to add

```
CTTY CON
```

to your AUTOEXEC.BAT to return the console to normal. Put it before any command that requires operator input.—*Douglas Hemminger; Elyria, Ohio*

CTTY > AUTOEXEC.LOG may look like ordinary redirection, but it definitely is not. The fact that it works at all is directly contrary to the DOS manual. The manual states that CTTY must be followed by a valid device name, and that redirection is not supported. Despite the manual, you *can* redirect CTTY this way in DOS 2.0 to 3.3. The first line of your output will always be an error message from CTTY itself: "Invalid device."

The technique works, but you're using a DOS *bug*, not a DOS *feature*. Don't try to use it under DOS 4.0.

Build a hard-disk menu system with ordinary DOS tools

I've used many menu programs for hard disks, but the best menu system is one I made using batch files, ANSI escape sequences, and function keys. By using generic names for the batch files, I can use the same keys in any directory of my hard disk, making my system very easy to access. The first line in my AUTOEXEC .BAT file is

```
PROMPT $e[0;59;"F1";13p
```

where `$e[ . . . p` indicates an ANSI key redefinition, `0;59;` is the scan code for redefining the F1 key, `''F1''` is the text string "F1", and 13 is the code for Enter.

In this example, the F1 key is redefined from its default value and now has a value of "F1" followed by Enter. When you press the F1 key, the computer looks for a file called F1 with a .BAT, .EXE, or .COM extension. It finds F1.BAT, which reads

```
ECHO OFF
CLS
CD GAMES
TYPE GAME.TXT
```

GAME.TXT is another menu. If you pressed F1 again you'd call a batch file named F1.BAT in the GAMES directory.

This will not interfere with any programs that use function keys to operate. The programs will take the keys and then, after you exit the program, restore them to the values you set.

The chart in Figure 1 shows the codes for function keys 1 through 10.—*Daniel Ullman; Seattle, Washington*

PC MAGAZINE Redefining Function Keys

Function key	Key scan code
F1	59
F2	60
F3	61
F4	62
F5	63
F6	64
F7	65
F8	66
F9	67
F10	68

Figure 1: *To redefine the ten function keys, substitute the scan code listed next to the key in the expression PROMPT $e[0;__;"F_";13p. For example: PROMPT $e[0;67;"F9";13p.*

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CIRCLE 170 ON READER SERVICE CARD

■ USER-TO-USER

```
ECHO OFF
PATH C:\MENU;C:\DOS
PROMPT $e[0;59;"F1";13p
PROMPT $e[0;60;"F2";13p
PROMPT $e[0;61;"F3";13p
PROMPT $e[0;62;"F4";13p
PROMPT $e[0;63;"F5";13p
PROMPT $e[0;64;"F6";13p
PROMPT $e[0;65;"F7";13p
PROMPT $e[0;66;"F8";13p
PROMPT $e[0;67;"F9";13p
PROMPT $e[0;68;"F10";13p
PROMPT $P$G
ECHO OFF
CLS
REM FKEYMENU.TXT is a file that you will create
REM to describe what each function key does.
TYPE \MENU\FKEYMENU.TXT
```

Figure 2: *FKEYMENU.BAT illustrates how you can build a generic menu. What you put in files F1.BAT through F10.BAT will determine what this menu does.*

The final comment about other programs using function keys isn't quite correct. Programs that use DOS to get input will be affected by the key redefinitions. However, all major applications read the keyboard in a more sophisticated way. They don't take away the key definitions and restore them—they simply ignore them.

If you normally load ANSI.SYS in your CONFIG.SYS file, this is a painless way to make yourself a menu. Note that since it defines each function key as "F?" (where *?* is the number), it will always search the *current* directory first for a matching file. This means you can create submenus simply by having the F?.BAT file change to another directory that also contains F?.BAT files.

FKEYMENU.BAT in Figure 2 uses this technique. It assumes that you have a subdirectory called \MENU in which you store your F?.BAT files and the menu text. By putting C:\MENU on the PATH, you make the F?.BAT files available from any directory. However, local F?.BAT files in the current directory will supersede them. That's convenient!

Create a batch file that displays your machine's ID

Our school uses a mix of Tandy 1000 EXs and Cordata CS 40s hooked to various printers. Since beginning students can never remember to use the correct .BAT file, we needed a way to set the correct printer definition based on the machine they were using.

ID.COM is called in a batch file, finds the machine ID and sets the ERRORLEVEL. The batch file tests the ERRORLEVEL and branches accordingly.

The machine ID for most PCs and compatibles can be found by starting DEBUG and typing

```
D  F000:FFFE L 1<ENTER>
```

This will display two letters, which represent the machine ID in hex:

```
IBM PC, Tandy 1000     0FFh (255)
IBM PC XT, Cordata CS40 0FEh (254)
```

The machine IDs would need to be different for this to work. Since we have two

```
N ID.COM
RCX
C
A 100
MOV       AX,F000
MOV       DS,AX
MOV       AL,[FFFE]
MOV       AH,4C
INT       21

W
Q
```

Figure 3: *Pass this script as input to DEBUG to create ID.COM.*

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CIRCLE 385 ON READER SERVICE CARD

■ USER-TO-USER

```
ECHO OFF
ID
SET ID=unknown
FOR %%n IN (48 49 50 51 52 53 54 55) DO IF ERRORLEVEL 24%%n SET ID=24%%n
GOTO %ID%
:255
ECHO PC
GOTO end
:254
ECHO PC XT (early)
GOTO end
:253
ECHO PCjr
GOTO end
:252
ECHO AT -or- XT-286 -or- PS/2 model 50 and 60
GOTO end
:251
ECHO    XT (later)
GOTO end
:250
ECHO PS/2 model 30
GOTO end
:249
ECHO PC convertible
GOTO end
:248
ECHO PS/2 model 70 and 80
GOTO end
:unknown
ECHO Unknown machine type
:end
ECHO The machine ID code is now available for use in your
ECHO other batch files -- in the environment variable ID.
```

Figure 4: *GET_ID.BAT names your machine type and leaves the ID byte accessible in the environment variable ID.*

different brands of computers with different IDs, it does.

To create ID.COM, type in the script in Figure 3 with a pure ASCII text editor. Be sure to hit the Enter key at the end of each line, and also to include the blank line before the W line. Then get back to DOS and type

```
DEBUG < GET_ID.SCR
```

to create the file. The batch file in Figure 4 shows a sample application.—*Dennis Landis; Orrville, Ohio*

The ID bytes can have eight values, from F8h (248) through FFh (255), with each value representing one or more machines.

Figure 4 is a batch file that displays the machine names associated with your computer's ID byte. One of the machine ID codes seems overloaded—FCh (252) is the ID for 4 different computers. On machines with an AT or PS/2 BIOS, you can call interrupt 15h, function C0h to get the "submodel byte" that distinguishes among these machines. But the simple ID program presented here will at least distinguish between the eight main ID bytes.

I simplified the original ID.COM to make it return the computer ID bytes *exactly*. This way, if new machines appear with new ID values, ID.COM won't have to change.

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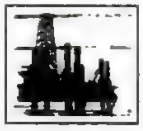
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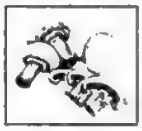
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CIRCLE 155 ON READER SERVICE CARD

Use an alternative AUTOEXEC to maximize free memory for RAM-hungry programs

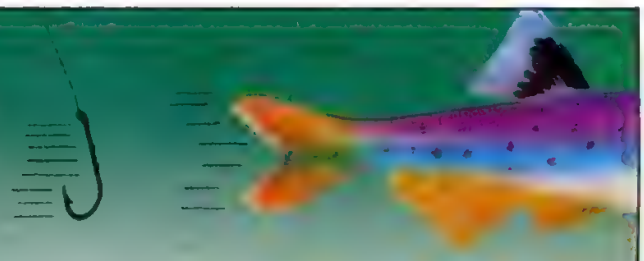
Occasionally, I use programs that are too big to fit in memory. Even with 640K of RAM, much of my memory is used by TSR programs invoked by AUTOEXEC.BAT and by large device drivers (for example, a RAMdisk) in CONFIG.SYS. *PC Magazine*'s INSTALL.COM and REMOVE.COM are excellent for managing TSR programs, but the device drivers in CONFIG.SYS can use too much memory.

To free up all the RAM I can, I developed a batch file that renames AUTOEXEC.BAT and CONFIG.SYS, and prompts me to reset the system. The new AUTOEXEC.BAT file restores the original files, but until you reboot, DOS is the only thing still in RAM. The prompt indicates that RAM has been maximized, and I can

```
ECHO OFF
REM ------------------THIS WORKS WITH THE FILE MAXRAM.MAX
IF NOT EXIST CONFIG.MAX GOTO RENAMER
DEL AUTOEXEC.BAT
RENAME AUTOEXEC.MAX AUTOEXEC.BAT
RENAME CONFIG.MAX CONFIG.SYS
CLS
ECHO     MAXRAM has renamed AUTOEXEC.BAT and CONFIG.SYS.
ECHO     The system will be normal when it is reset.
GOTO END
:RENAMER
RENAME AUTOEXEC.BAT AUTOEXEC.MAX
RENAME CONFIG.SYS CONFIG.MAX
COPY MAXRAM.MAX AUTOEXEC.BAT
CLS
ECHO     MAXRAM has renamed AUTOEXEC.BAT and CONFIG.SYS.
ECHO     The maximum amount of memory will be available
ECHO     when the system is reset.
ECHO              *
ECHO     Reset the computer now
ECHO     CTRL + ALT + DEL
PROMPT Press Ctrl-Alt-Delete NOW!
:END
```

Figure 5: *MAXRAM.BAT sets up your computer to reboot with maximum free RAM.*

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■ USER-TO-USER

then run my large programs. The next time I reset the system, I will have the use of my TSR programs and RAMdisk, and everything is back to normal.

MAXRAM.BAT in Figure 5 and MAXRAM.MAX in Figure 6 work together. MAXRAM.BAT does all file renaming and MAXRAM.MAX replaces AUTOEXEC.BAT.—*David F. Hill; Austin, Texas*

I use a very similar technique to manage conflicting EMS drivers—loading a different one requires me to switch to a different CONFIG.SYS and reboot. In order to make sure I don't get distracted and forget to reboot, I change the prompt to a reminder. I've added this feature to MAXRAM.BAT.

If you do use a system like MAXRAM, be sure to keep spare copies of your AUTOEXEC.BAT and CONFIG.SYS, and keep the copies up to date. It's always possible that something untoward could happen and you could lose your AUTOEXEC.BAT.

Productivity Tip

The REPLACE command (introduced in DOS 3.2) lets you update files on one disk with their newer versions from another disk. Suppose you copied three floppy disks to a single hard disk directory and made changes to the files on the hard disk. You can automatically copy only the updated files back to the appropriate floppy with the command

```
REPLACE *.* A:
```

```
ECHO OFF
REM ------------THIS WORKS WITH THE FILE MAXRAM.BAT
CLS
PROMPT MAXRAM $P$G
MAXRAM
```

Figure 6: *MAXRAM.BAT replaces AUTOEXEC with this file, MAXRAM.MAX.*

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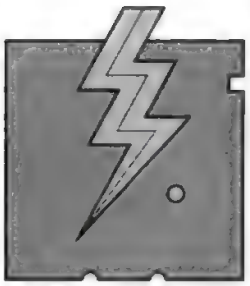
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CIRCLE 735 ON READER SERVICE CARD

■ EDITED BY CRAIG L. STARK



POWER USER

WordPerfect 5.0's advanced macro features give you a great deal of power and flexibility. Here are some useful techniques for creating your own pop-up menus.

WordPerfect 5.0's advanced macros let you create your own pop-up menus and help windows

The advanced macro features in *WordPerfect*, Version 5.0, are seriously underdocumented. It's a shame because when properly applied, they provide a great deal of extra power and flexibility.

While writing a book on *WordPerfect* macros for Bantam Computer Books, I found that one of the least understood macro features is the {^P} display code, which is used to place a message anywhere on the screen. The {^P} code is used in {PROMPT}, {TEXT}, and {CHAR} message strings, and it is followed by two characters. The first character indicates a column position (from 1 to 80); the second character indicates a line position (from 1 to 24). By judiciously calculating the column and line positions, you can produce pop-up menus of any size or shape.

The {^P} display code uses either control characters (^A, ^B, ^C, and so forth), or the IBM Extended Character Set char-

```
{ON CANCEL}{GO}cancel~~

{ON NOT FOUND}{GO}not found~~

{LABEL}draw font box~
{CHAR}1~
    {^P}õU                                          {Enter}
    {^P}õ6 ··Select a font:·····                    {Enter}
    {^P}õå ··1··Helvetica·····                      {Enter}
    {^P}õÄ ··2··Helvetica Bold·····                 {Enter}
    {^P}õà ··3··Helvetica Bold Oblique·····         {Enter}
    {^P}õÅ ··4··Helvetica Narrow·····               {Enter}
    {^P}õç ··5··Helvetica Narrow Bold·····          {Enter}
    {^P}õé ··6··Helvetica Narrow Bold Oblique··     {Enter}
    {^P}õè ··7··Helvetica Narrow Oblique·····       {Enter}
    {^P}õà ··8··Helvetica Oblique·····              {Enter}
    {^P}õI                                          {Enter}
    {Home}

{LABEL}test entry~
{IF}{VAR 1}>0~
    {ELSE}
        {GO}wrong entry~
{END IF}

{IF}{VAR 1}<9~
    {ELSE}
        {GO}wrong entry~
{END IF}
{GO}draw size box~

{LABEL}wrong entry~
    {LOOK}1~
    {PROMPT}{Home}~
    {GO}test entry~

{LABEL}draw size box~
    {DISPLAY OFF}
    {DISPLAY ON}

{TEXT}0~
    {^P}õl                                          {Enter}
    {^P}õÄ ··Enter a font size·····                 {Enter}
    {^P}õÅ                                          {Enter}
    {^P}¬Ä~

{IF}{VAR 0}<128~
    {ELSE}
        {GO}wrong size~
{END IF}

{IF}{VAR 0}>3~
    {ELSE}
        {GO}wrong size~
{END IF}
{GO}choose font~

{LABEL}wrong size~
    {BELL}
    {PROMPT}Choose a size between 4 and 127 points.··~
    {WAIT}20~
    {GO}draw size box~

{LABEL}choose font~
{DISPLAY OFF}

{CASE}{VAR 1}~

    1~Hel~
    2~Bold~
    3~Bold oblique~
    4~Narrow~
    5~Narrow bold~
    6~Narrow bold oblique~
    7~Narrow oblique~
    8~Oblique~
    ~

{LABEL}Hel~
{Font}4nHelvetica{Enter}1{VAR 0}{Enter}
{QUIT}

{LABEL}Bold~                                        (continues)
```

Figure 1: *This* WordPerfect *5.0 macro uses a pop-up window to prompt for a font selection; it illustrates several advanced macro techniques.*

■ POWER USER

```
{Font}4nHelvetica·Bold{Enter}1{VAR 8}{Enter}
{QUIT}

{LABEL}Bold·oblique~
{Font}4nHelvetica·Bold·Oblique{Enter}1{VAR 8}{Enter}
{QUIT}

{LABEL}Narrow~
{Font}4nHelvetica·Narrow{Enter}1{VAR 8}{Enter}
{QUIT}

{LABEL}Narrow·bold~
{Font}4nHelvetica·Narrow·Bold{Enter}1{VAR 8}{Enter}
{QUIT}

{LABEL}Narrow·bold·oblique~
{Font}4nHelvetica·Narrow·Bold·Oblique{Enter}1{VAR 8}{Enter} {QUIT}

{LABEL}Narrow·oblique~
{Font}4nHelvetica·Narrow·Oblique{Enter}1{VAR 8}{Enter}
{QUIT}

{LABEL}Oblique~
{Font}4nHelvetica·Oblique{Enter}1{VAR 8}{Enter}
{QUIT}

{LABEL}cancel~
    {DISPLAY OFF}
    {DISPLAY ON}
    {QUIT}

{LABEL}not·found~
    {PROMPT}Sorry,·can't·find·the·font...~
    {BELL}
    {WAIT}15~
    {Exit}{Exit}
    {DISPLAY OFF}
    {QUIT}
```

(Figure 1 ends)

acters (those with an ASCII value of 128 or more). The control character method is not recommended, as it precludes putting the start of the message at some locations on the screen. The better method is to use the Extended Character Set. Enter the appropriate column and line characters by holding down the Alt key and typing a number into the numeric keypad (not the number keys on the top row of the keyboard). For example, to enter ASCII 128, press and hold the Alt key, and type 1 2 8 on the numeric keypad. The Ç character will appear.

You need to identify both the column and line after the {^P} code, so you must enter two codes. The column code goes first, followed by the line code. For example, to position the message at the upper-left corner of the display (ASCII 128 for the column and ASCII 128 for the line), enter

```
{^P}ÇÇ Your message goes here.~
```

To determine the proper ASCII number to use for other locations, add 127 to the desired column or line number. To place the message starting at column 30 and line 15, for instance, use ASCII 157 (127 + 30) and ASCII 142 (127 + 15). In the IBM extended character set these will show on-screen as ¥ (ASCII 157) and Ä (ASCII 142).

You can start the message anywhere along the width of the display, up to column 80 (ASCII 207). After that, *WordPerfect* automatically wraps the start of the message onto the next line. Wrapping will also occur if the message extends beyond the 80th column. Additionally, you can start the message along the length of the display up to line 25. Realistically, you would not use the 25th line with the {^P} display code, however, since that's the status line used for *WordPerfect* message prompts.

A pop-up window is composed of separate lines in a {PROMPT}, {TEXT}, or {CHAR} message, and it has the effect of temporarily overwriting any text that's underneath. Once the window is removed from the screen, the original text reappears. By formatting the lines of the message with a box frame, you can make a realistic-looking pop-up window.

By way of illustration, Figure 1 contains a sample macro that displays a pop-up window that allows you to select one of several Helvetica font typefaces (it's for use with a PostScript-compatible laser printer). A second, smaller box prompts for the point size of the font.

Text within the pop-up window is formatted using empty spaces. Each line of the window *must* end with an {Enter} code. Be sure that you use the proper screen locations after the {^P} code or your window will be literally "shattered"—with segments strewn all over the screen!

Sadly, you cannot use *WordPerfect*'s Line Draw feature to make box frames for your pop-up windows. You must create them in the macro editor yourself by depressing Alt and typing a number on the numeric keypad, or with *WordPerfect*'s compose key.

When using the Alt-key method, press the Alt key and a number on the keypad for each segment of the frame. Use the Backspace and Delete keys to remove unwanted segments. When using the compose key method, press Ctrl-2, type the code for the segment you want to use (don't forget the comma), and press Enter. Repeat the process for each segment of the frame. Use the Backspace and Delete keys to remove unwanted segments.—*Gordon McComb; Canoga Park, California*

You can experiment with this macro even if your printer doesn't support Helvetica. You'll just get the message "Sorry, can't find the font" at the end. Naturally you're free to modify POP-UP.WPM so it presents fonts available on your system.

POP-UP.WPM uses many advanced macro features, so you can't just enter it in Macro Definition mode. You must carefully construct it within the macro editor. First, start an ordinary macro definition with the name POP-UP. Enter a description, if you like, and immediately end the definition by pressing Ctrl-F10 again. Now define POP-UP once more—*this* time you'll get a message inviting you to either replace the existing blank macro or edit it. Select #2, Edit, and you're in the macro editor. Again select #2 to get into editing the macro action.

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CIRCLE 289 ON READER SERVICE CARD

■ POWER USER

fully to Figure 1. There are several kinds of elements in the macro. Special commands, variables, and command keys appear in curly braces { }. Everything else is ordinary text.

- To insert a special command, hit Ctrl-PgUp and select it from the menu.
- To insert a command key, press Ctrl-V followed by the key.
- To insert a variable, press Ctrl-V and Alt-*n*, where *n* is the number of the variable.
- To insert ordinary text, just type it in.

Within the ordinary text, this macro uses six line-drawing characters to create boxes. It's easiest to enter these using the Alt-key method. The character numbers are: horizontal line, 205; vertical line, 186; upper-left corner, 201; upper-right corner, 187; lower-left corner, 200; lower-right corner, 188.

As you type, you'll notice that space characters in your macro are represented by a midline dot character. Press the Enter key at the end of lines, as usual. What is shown as {Enter} is a command key, so you'd press the three-key combination Ctrl-V-Enter to insert it. Don't try to type in the special commands using the { and } keys!

Creating this macro will take some effort, but you'll learn quite a bit about the advanced macro features of *WordPerfect* 5.0 in the process. When you've studied this one, add pop-up windows to your own macros. Anywhere you're prompting the user for information, you can expand the prompt into a helpful window.—*Neil J. Rubenking*

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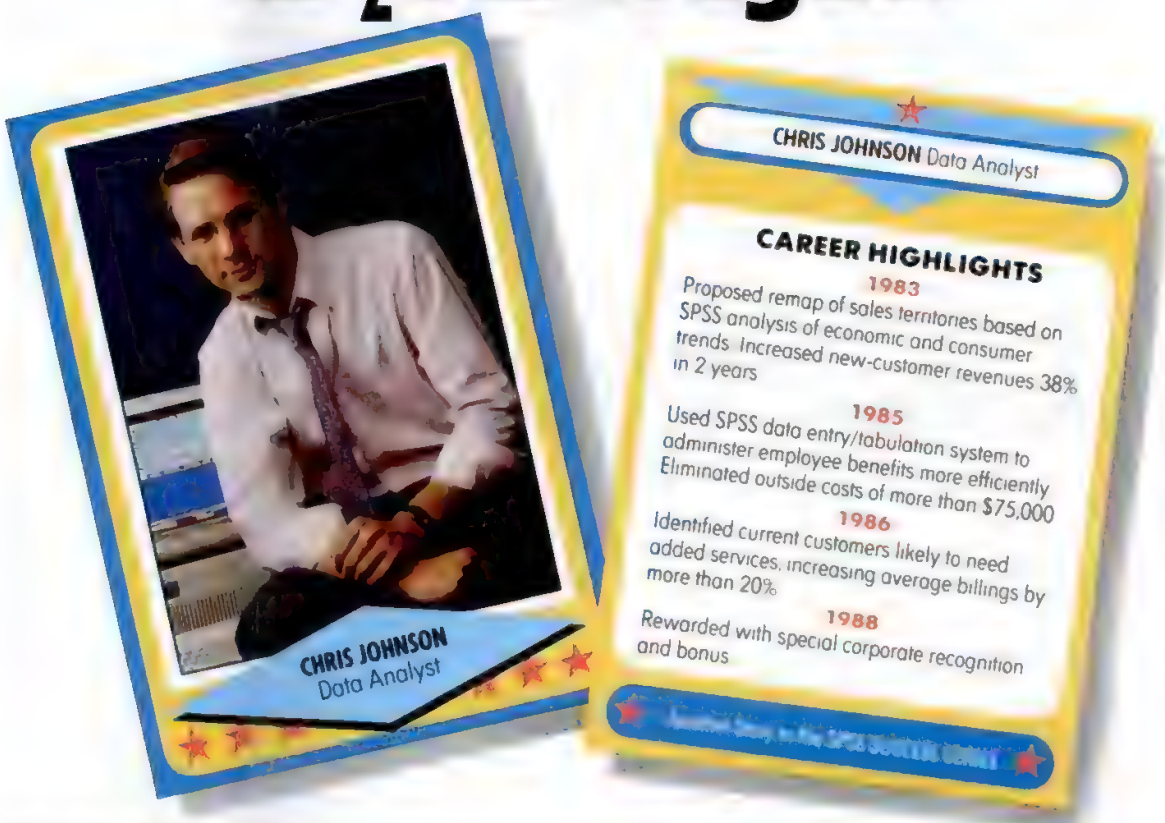


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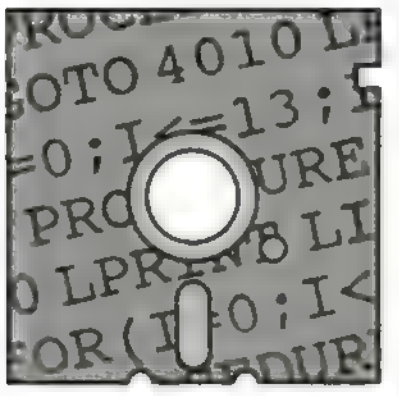
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■ **EDITED BY ROBERT L. HUMMEL**

LANGUAGES



A quicker way to search text in BASIC; Turbo Pascal routines for creating your own editor; an automatic word-align function in Turbo Pascal 5.0.

Writing your own editor? These Turbo Pascal routines may get you started

When handling text files in Turbo Pascal, it is convenient to read the file into an array of strings. While this may be fine for some applications, the array size is limited by the 64K data segment that must be shared with other variables. Another way to buffer text is to allocate memory dynamically from the heap using GetMem.

My sample program LINKTEXT.PAS, shown in Figure 1, demonstrates how to read a text file into a singly linked list. Each element in the list contains a string and a pointer to the next element. The "Head" record is actually a dummy element, which contains only a pointer field that always points to the first real element in the list. Notice that we must allocate 5 bytes more than the length of the string. This allows for the length byte of the string and the 4 bytes required for the pointer field.

The procedure DisplayFile traverses the list from top to bottom and writes each line of the list. The DeleteLine and InsertLine procedures show how to insert and delete records from this type of list by changing pointers.—*Michael A. Reeder; Beaumont, Texas*

```
PROGRAM LinkText;
USES Crt;     { Omit this line for version 3 }
TYPE
  AnyStr = STRING[255];
  LinePtr = ^LineRecType;
  LineRecType = RECORD
                  NextLine : LinePtr;
                  LineField : AnyStr;
                END;                  { of LineRecType }

VAR
  TextFile : Text;                    { Input File     }
  Head : LinePtr;                     { Head of List   }
  Hold : LinePtr;                     { Place Holder   }
  Cur : LinePtr;                      { Current Line   }
  FileName : AnyStr;                  { File Name      }
  Ok : Boolean;                       { I/O Error Flag }
  LineBuf : AnyStr;                   { Input String   }
  L : Integer;                        { Line Number    }


  PROCEDURE LoadFile;
  { LoadFile prompts for a file name and
   loads the file into a linked list }
  BEGIN
    ClrScr;
    Write('Enter File Name: ');
    ReadLn(FileName);
    Assign(TextFile, FileName);
    {$I-} Reset(TextFile) {I+} ;
    Ok := (IoResult = 0);
    IF Ok THEN
      BEGIN
        GetMem(Head, 4);
        Head^.NextLine := NIL;    { Initialize Head }
        Hold := Head;
        WHILE NOT Eof(TextFile) DO
          BEGIN
            ReadLn(TextFile, LineBuf);
            GetMem(Cur, Length(LineBuf)+5); { Allocate Memory }
            Hold^.NextLine := Cur; { Set previous pointer }
            Cur^.NextLine := NIL; { Cur goes at end of list }
            Hold := Cur;          { Save Current pointer }
            Cur^.LineField := LineBuf;
          END;
        Close(TextFile);
      END;
  END;                                { of LoadFile }

PROCEDURE DisplayFile;
{ DisplayFile traverses the list and writes each line }
BEGIN
  ClrScr;
  Cur := Head^.NextLine;
  WHILE Cur <> NIL DO
    BEGIN
      WriteLn(Cur^.LineField);
      Cur := Cur^.NextLine;
    END;
END;                                  { of DisplayFile }

PROCEDURE DeleteLine(N : Integer);
{ DeleteLine deletes the Nth line of the buffer. }
VAR
  Count : Integer;
BEGIN
  Hold := Head;
  Cur := Head^.NextLine;
  Count := 1;
  WHILE (Count < N) AND (Cur <> NIL) DO
    BEGIN
      Hold := Cur;                { Save current pointer }
      Cur := Cur^.NextLine;       { Advance to next line }
      Count := Succ(Count);       { Increment counter    }
    END;
  IF (Cur <> NIL) AND (Count = N) THEN
    BEGIN
      Hold^.NextLine := Cur^.NextLine; {  skip current line }
      FreeMem(Cur, Length(Cur^.LineField)+5);
    END;
END;                                  { of DeleteLine }

PROCEDURE InsertLine(N : Integer; NewStr : AnyStr);
{ InsertLine inserts the line NewStr before line N. }
VAR
  Count : Integer;
  NewLine : LinePtr;
BEGIN
  Hold := Head;
  Cur := Head^.NextLine;
  Count := 1;
  WHILE (Count < N) AND (Cur <> NIL) DO
    BEGIN
      Hold := Cur;                { Save current pointer }
      Cur := Cur^.NextLine;       { Advance to next line }
      Count := Succ(Count);       { Increment counter    }
    END;                                                  (continues)
```

Figure 1: *The LINKTEXT.PAS program provides the basics for writing a simple editor.*

■ LANGUAGES

```
    GetMem(NewLine, Length(NewStr)+5);
    Hold^.NextLine := NewLine;     { Change pointers to link }
    NewLine^.NextLine := Cur;      {    in the new line      }
    NewLine^.LineField := NewStr;
  END;                             { of InsertLine }

BEGIN                              { Main }
  LoadFile;
  IF ok THEN
    BEGIN
      DisplayFile;
      WriteLn; Write('Enter line number to delete: '); ClrEol;
      ReadLn(L);
      DeleteLine(L);
      DisplayFile;
      WriteLn; Write('Insert string before what line? '); ClrEol;
      ReadLn(L);
      InsertLine(L, 'This string to be inserted before line specified');
      DisplayFile;
    END
  ELSE WriteLn(FileName, ' NOT FOUND');
END.
```

(Figure 1 ends)

Borland's Editor Toolbox contains a data type similar to the LineRecType in LINKTEXT.PAS. The Editor Toolbox version is fancier, with links both forward and backward, and a "flags" byte to hold special codes. But the basic technique is the same.

If you were actually going to build an editor around the routines in Figure 1, you would need to add at least two more features. First, you'd need a routine to unload a file. It wouldn't be difficult, but for each line you'd have to use FreeMem to deallocate exactly the same number of bytes that you allocated with GetMem. Second, you'd need a routine to edit a line. The easiest way to do that would be to use existing routines to delete the old line and insert the edited version.—*Neil J. Rubenking*

Documenting fields in the BASIC BLOAD Header

I would like to make a correction to Ethan Winer's excellent article "Fast Screen Writing in BASIC, Part 1" (PC Lab Notes, October 13, 1987). The sixth and seventh bytes in a binary file created by BASIC with BSAVE hold the file's length, which is used by BASIC to know how many bytes to load, even if the file is larger. I take advantage of this by writing information about a BSAVEd screen directly following the screen data. When the file is BLOADed only the original screen is retrieved, and not the other information in the file that follows.—*Ted Swirsky; Horsham, Pennsylvania*

While I was working on that article I wondered aloud why the BLOAD header also included the SEGMENT from which a file had been saved, because it did not appear to be used for anything. I discovered that if an address is not given when a file is BLOADed, the original address *and* the segment will be used.—*Ethan Winer*

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Turbo Pascal 5.0 word-aligns some variables—even if you tell it not to

Turbo Pascal 5.0 has the ability to word-align (store at an even offset in memory) all variables larger than 1 byte. This can result in increased speed on 80286 computers. The {$A±} compiler directive globally controls whether word alignment is on or it is off.

If a program makes assumptions about the relative addresses of variables, word alignment can throw it off. For example, programs that configure themselves by modifying typed constants within the EXE file usually assume those constants will be contiguous in memory. When your programs require that variables be contiguous, use {$A-} to turn off word alignment.—*Jason Destin; Miami Beach, Florida*

The directive {$A-} doesn't completely eliminate word alignment. The first variable in any VAR declaration is aligned on a word boundary, even when you've set {$A-} and regardless of the variable's size. This can conceivably be a problem, because Turbo Pascal allows multiple VAR declarations. The program in Figure 2 demonstrates this effect. The first group of variables, X1, Y1, and Z1, are all in the same VAR declaration. Because word alignment is off, Y1 resides in memory immediately after X1. Variable Z1 is a word that overlaps both X1 and Y1, so making an assignment to Z1 affects both of the other two.

The second group differs only in that there is another VAR line between the X2 and Y2 variables. This makes a big difference, though. Variable Y2 is now also word-aligned, so it does NOT follow immediately after X2. An assignment to Z2 does NOT affect Y2. The WriteLn statements demonstrate this fact. To make things very clear, I fill the whole data area with $FF before the assignments.

Note that the demo program in Figure 2 is using byte variables. According to the manual, even with {$A+}, Turbo Pascal 5 doesn't word-align variables unless they're larger than 1 byte. So this oddity could surprise you even with word alignment ON.—*Neil J. Rubenking*

Make your text searches faster in BASIC without using assembly language

Microsoft's QuickBASIC compares integers more quickly than strings. Thus it is possible to speed up searching through string data by doing a hybrid search in

```
PROGRAM Alignment_demo;
{$A-}
VAR
  X1 : Byte;  Y1 : Byte;
  Z1 : Word ABSOLUTE X1;
VAR
  X2 : Byte;
VAR
  Y2 : Byte;
  Z2 : Word ABSOLUTE X2;
  dummy : byte;
BEGIN
  FillChar(X2, Ofs(dummy) - Ofs(X1), $FF);
  Z1 := $0101;
  Z2 := $0202;
  WriteLn('X1=',X1,' Y1=',Y1);
  WriteLn('X2=',X2,' Y2=',Y2, ' (Y2 should equal 2)');
  WriteLn('Note that the offsets below are all EVEN.');
  WriteLn('Offset of X1=',Ofs(X1));
  WriteLn('Offset of X2=',Ofs(X2));
  WriteLn('Offset of Y2=',Ofs(Y2));
END.
```

Figure 2: *Turbo Pascal 5.0 always word-aligns the first variable of a VAR block.*

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CIRCLE 331 ON READER SERVICE CARD

```
DEFINT A-Z
FOR i = 1 TO n
   IF search$ = array$(i) THEN
     PRINT search$; " found at element"; i
     EXIT FOR
   END IF
NEXT
```

Figure 3: *The conventional way to search a string array in BASIC, while effective, is slow.*

```
DEFINT A-Z
a = ASC(search$)
FOR i = 1 TO n
  IF a = ASC(array$(i)) THEN
     IF search$ = array$(i) THEN
       PRINT search$; " found at element"; i
       EXIT FOR
     END IF
  END IF
NEXT
```

Figure 4: *An improved search method tests with ASC() to speed up string searches.*

which the ASCII value of the string is used first as a precursor to a full comparison. The standard way that you search through a string array is by comparing each element directly, as in the program fragment STRING1.BAS, shown in Figure 3 above.

A much better approach is given in STRING2.BAS (Figure 4), which can perform as much as 60 percent faster as STRING1.BAS. The improvement will not be noticed unless the program is compiled to an .EXE file.—*Norman Swartz; Burnaby, British Columbia, Canada*

String operations are one of the slowest things that QuickBASIC does, and checking the ASCII value of each element does indeed quickly weed out those strings that couldn't possibly match. Be aware that both of the methods shown are case-sensitive, which means that searching for Smith will not find SMITH or smith.—*Ethan Winer*

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■ ROBERT L. HUMMEL

PC TUTOR



Preventing batch files from ending prematurely; examining large files with DEBUG; interpreting PCMAP's output; producing the ESC character you need for ANSI commands.

The output of the PCMAP program can be confusing

When the BASIC program for PCMAP appeared in the August 1987 PC Lab Notes column, I keyed it in and created it. I have used the program to find what is in memory a number of times. But recently, I tried to use it to find why *Quattro* said I had only 107K of memory free. It was then I found that PCMAP gives ludicrous results.

Figure 1 shows a printout of the PCMAP results. PCMAP gives CA and C8 as the length of COMMAND.COM and 1DEE as the length of PCMAP!

In all honesty, I am not writing to complain but to inquire whether you have a revised version of PCMAP. It's possible that I may have overlooked a printed correction.—*R. Clark Jones; Cambridge, Massachuseits*

As strange as the results may seem, there's nothing wrong with PCMAP. Because it's such a small utility and there isn't a lot of code spent on making the display pretty or easy to read, it may take some explanation to make sense of the numbers.

First, all the numbers listed are in hexadecimal and may have to be converted to decimal to make sense. The first column, "Segment," is the segment of the program that owns the memory. This is also called the Process Identifier (PID).

The second column, "Paragraphs," gives the total number of paragraphs of memory allocated to this PID. A paragraph is 10h (16) bytes, and this number includes the program block, environment block, and any other memory the program may have allocated.

The third column gives the name of the program if available. The name is maintained only by DOS 3.0 and later and can be obtained—unless the program releases its environment block when it's loaded, as some memory-resident programs do.

The first entry in Figure 1 lists the size of COMMAND.COM as CAh paragraphs. This is 3,232 bytes, and it represents the size of the resident portion that COMMAND.COM leaves in memory when running another program. DISKLITE.COM is a memory-resident program. Another program (unknown) is also memory resident.

The program TURBO.EXE is in memory, and it occupies 32F2h paragraphs, or 208,672 bytes. From this program, you invoked a second copy of COMMAND.COM, which was loaded into memory. You then executed PCMAP. This caused COMMAND.COM to release all but C8h paragraphs of itself (3,200 bytes) and run PCMAP.COM. Because .COM programs are allocated all memory when they start, PCMAP is shown as owning 1DEEh paragraphs (122,592 bytes).

A bug in the IBM PC-XT BIOS causes some video routines to return incorrect values

I'm having trouble understanding the ROM BIOS video function 3, Read Cursor Position. When I boot my IBM PC-XT with a monochrome display, the cursor is obviously at scan lines 11–12. But the Read Cursor function tells me the cursor is sitting at scan lines 6–7. On returning to DOS after executing BASICA, the function properly reports scan lines 11–12. But returning to DOS after running my editor has Read Cursor reporting lines 6–7 again.

What's causing the Read Cursor func-

```
PCMAP 1.0 (c) 1987, Ziff-Davis Publishing Corp.

Segment Paragraphs    Program
4C22       00CA       COMMAND.COM
4CEE       0003       (Free)
4CF8       0019       DISKLITE.COM
4D0D       0005       (Free)
4D13       013F       (Unknown)
4E5C       32F2       TURBO.EXE
8150       00C8       COMMAND.COM
821A       1DEE       PCMAP.COM
```

Figure 1: *The output from the PCMAP program displays the programs in memory and the amount of memory they are allocated. As strange as they seem, these results are correct.*

■ PC TUTOR

tion to get its data from something other than the actual cursor? None of this happens on my IBM PC-XT/286.—*Barry Gordon; New York, New York*

The IBM BIOS in your model of IBM PC-XT has a bug that causes it to perform exactly as you describe. The BIOS sets the cursor registers that control the cursor shape correctly for the Monochrome Display Adapter (MDA), but it sets the BIOS data area in low memory to reflect a Color Graphics Adapter (CGA) cursor.

This problem was fixed in later versions of the BIOS, as you observed. Installing an EGA or VGA will also solve the problem since these cards carry a replacement video BIOS.

Three ways to produce the ESC character for sending commands to the ANSI screen driver

Can you explain how I can create the ^[escape sequence on a Compaq Portable I computer? A friend showed me how to use it to reverse the video, change the screen colors, and so forth. I've installed the ANSI.SYS device driver in my CONFIG.SYS file, but I still can't produce the correct character.—*Clifford N. Nelson; Herndon, Virginia*

The ESC character can be produced in a number of ways. Unfortunately, pressing the Esc key is not one of them. You can use BASIC to issue the ANSI command that clears the screen by entering and running

```
10 PRINT CHR$(27)+"[2J"
```

The BASIC function CHR$ is used to produce the ESC character, which has a decimal value of 27. The ESC character, followed by a left bracket, is the ANSI command prefix. The 2J is the ANSI instruction to clear the screen.

If you have a text editor that allows all characters to be entered, you can write ANSI control strings directly into your batch files. *PC Magazine*'s TED.COM, which appeared in the November 15, 1988, Utilities column, allows the ESC character to be entered directly into text files.

Finally, the small utility ESCAPE.COM was published in the January 31, 1989, Utilities column along with our replacement for ANSI.SYS. This small program solves the problem of entering escape sequences at the DOS prompt.

The BAC.COM utility won't copy very large files

The BAC program on your PC Utilities disk has the potential of being a great program—but I can't make it work.

I'm trying to copy a very long file from my hard disk to a 1.2MB floppy disk. BAC works if the file to be copied is less than one floppy disk long. Otherwise, the program keeps prompting you to enter a new disk, even if two disks would be enough. When I check the disks it makes under these conditions, there are no files on them at all. Any suggestions?—*Holton E. Harris; Westport, Connecticut*

■ TED.COM allows the ESC character to be entered directly into text files.

The BAC program (Utilities, August 20, 1985) employs a very simple algorithm: if the size of the file to be copied is larger than the amount of free space on the target disk, ask for a new disk. So attempting to BAC a file that is 1.4MB, for example, to a 1.2MB drive is doomed to failure. No 1.2MB disk will ever have 1.4MB of free space. BAC also does not split files across disks. Therefore, no file that is larger than the size of the target disk can be copied.

The DEBUG program can be used to examine data files that are larger than 64K

In PC Tutor, September 27, 1988, you discussed the DEBUG program. This brought to mind a problem I have had examining some large data files with DEBUG. It seems that DEBUG can display only the first 64K of a file. Is there any way I can look at the part of a file that exceeds 64K?—*Dan Kubala; Chicago, Illinois*

DEBUG can be used to examine large files, but it requires a little manual intervention and math on your part. The D (dump) command in DEBUG displays the contents of memory. If you specify a starting address (D 12A4, for example) the dump starts at this address. If not, the dump starts at the end of the previous dump or 100h if it's the first dump. If you specify only an offset, the dump uses the value of the DS (data segment) register for the segment. Unless you specify a segment in the dump command (D F334:1023, for example) or change the value of the DS register, you are limited to examining 64K.

To see more of the file, you must add 1000h to the segment. If, after loading the file, DS=1456, entering

```
RDS
2456
```

will change DS to point to the second 64K of the data file. Alternatively, you could simply specify the segment by entering the command

```
D 2456:0
```

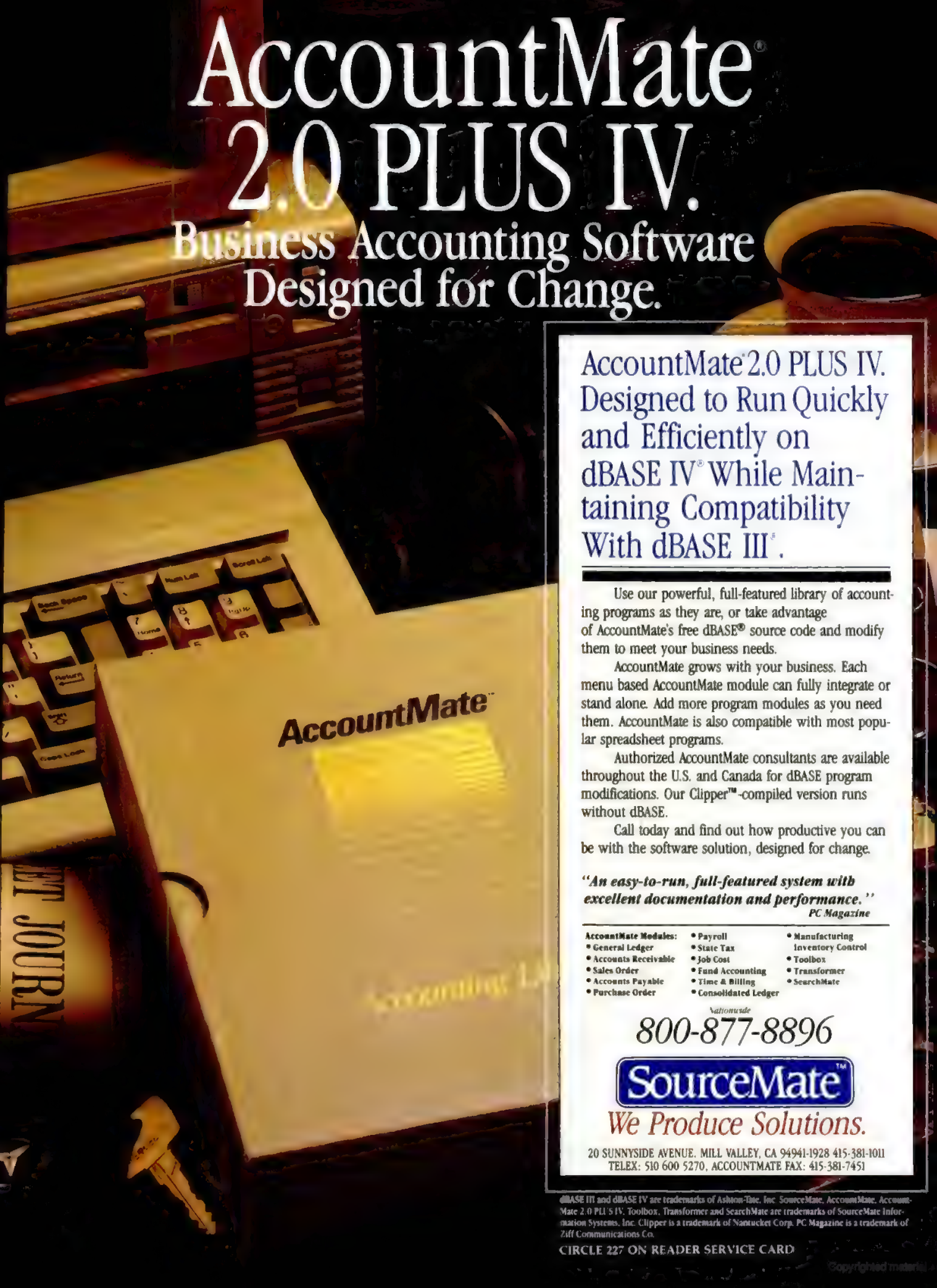
to display data after 64K.

Note that this technique won't work with .EXE files. Parts of these files are relocated in memory when they are loaded and are not pointed to by the DS register.

How to prevent some programs from ending batch files prematurely

I like to use DOS batch files to create menu systems. I create my menu screen display using the command TYPE MENU.TXT in my AUTOEXEC.BAT file and at the end of each batch file that executes a program. This works most of the time, but not always.

Often, after the program that's selected by a batch file ends, the command prompt is displayed instead of executing the remaining commands in the batch file. Is there any way to avoid dropping to the



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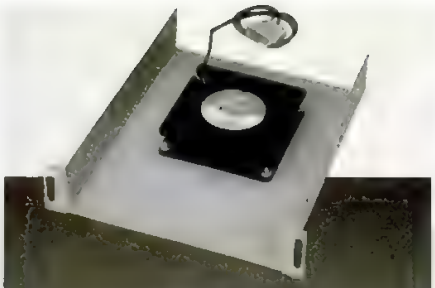
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■ PC TUTOR

prompt? Why does this happen?—*Roger Chalonec; Virginia Beach, Virginia*

What a program does when it runs and how it returns to DOS can affect the way a batch file is executed. If a program executed by the batch file encounters a critical error, such as attempting to read from an empty disk drive, and the operation aborts, the batch file processing may not be continued when control returns to DOS.

■ DEBUG can be used to examine large files, but it requires a little manual intervention on your part.

One method of minimizing the risk of early termination is to insulate the execution of troublesome programs from the parent batch file by executing them with another copy of COMMAND.COM. For example, if the program GOLFER is causing problems, try these batch file commands:

```
CLS
COMMAND /C GOLFER
TYPE MENU.TXT
```

Note, however, that using this extra copy of COMMAND.COM will reduce the amount of memory that GOLFER has to execute in, but all the memory will be freed when GOLFER terminates.

Ask the PC Tutor

The PC Tutor solves practical problems, explains points of general interest about using your hardware and software more productively, and answers basic questions about DOS and systems in general. To have your questions answered here, write to PC Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016 or upload them to PC MagNet (to join, see the "By Modem" sidebar in the Productivity section). We're sorry, but we cannot answer questions personally. PC

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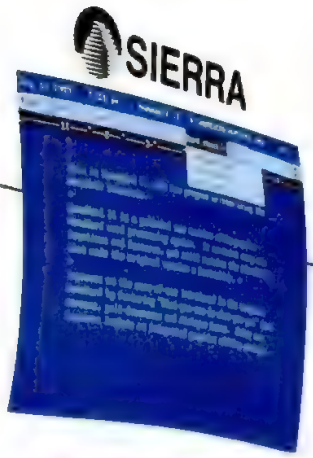
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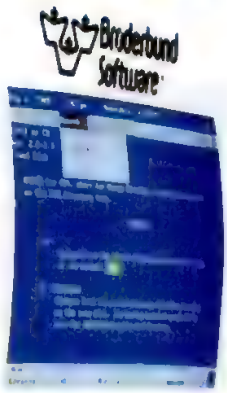


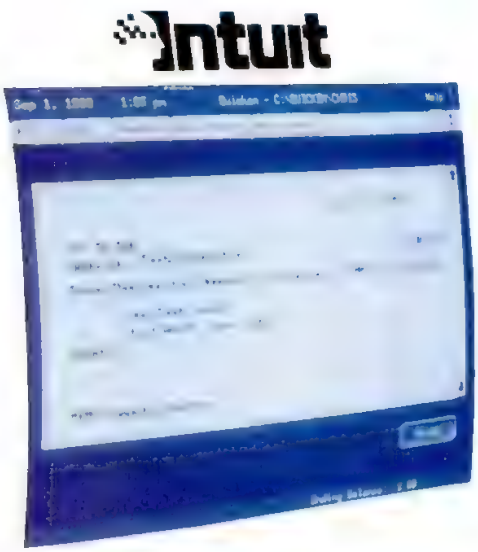






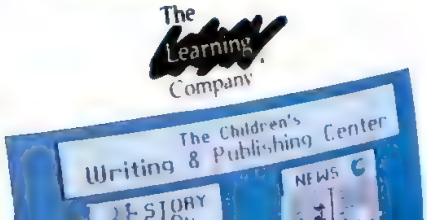
















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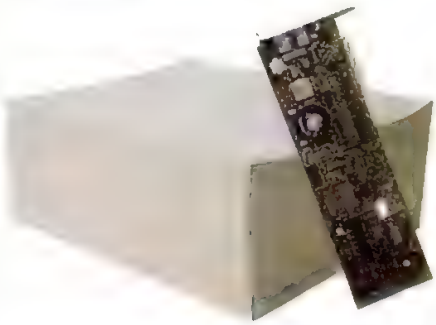
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CONNECTIVITY CLINIC



Shortcuts for loading NetWare drivers for new networking cards; combining operating systems on the same cable is easy; replacing a minicomputer with a LAN.

Today's LAN can replace a minicomputer

PC Magazine has carried articles on big, fast 386 machines, on networks, and on networked databases. What happens when you put the pieces together? Have networked PCs advanced to the point where they can effectively replace a minicomputer?

The association I work for, which serves 55,000 members, would gladly unload its expensive HP 3000 system if a 386-based system could handle 12 active terminals, eight interrelated databases, about 1.5 gigabytes of data on-disk, and a couple of high-speed printers.

Should I call the Compaq, Novell, and Clarion dealers or expect to pour money into the mini for a few more years? *—Henry S. Noble; Gaithersburg, Maryland*

Today's LAN hardware and software can do the job for you, but there are some important things you should consider before calling Hewlett-Packard to come and take away its iron. Let's take your requirements one by one.

Twelve active terminals and two printers are no sweat. Three factors are important in delivering service to the terminals: the efficiency of the networking software, the speed of the server's hard disk drive, and the efficiency of the network interface cards. I would use an ALR 386/220, a Compaq 386, or an IBM PS/2 Model 80 as the server. Use ARCnet, Ethernet, or Token-Ring network interface cards (my preference, in that order) and invest in one high-quality network interface card with a 16-bit or Micro Channel interface for the server.

The configuration of your 1.5-gigabyte datafile is important in selecting your networking software. Novell's *SFT NetWare*, for example, can handle only a maximum volume size of 255MB. You can put up to eight hard disk controllers in a *NetWare* server, and each controller can handle two drives; so you can get plenty of storage, but it is not contiguous.

You can get more contiguous storage (theoretically up to 4 gigabytes) out of *3+Open* running over OS/2, but you will probably have to arrange the drive with very large clusters that make for inefficient storage.

Frankly, I see developing the database structure as the most complex job that you will have to face. You should take plenty of time and get the application right before you give HP the old heave-ho.

The major advantages you will enjoy by replacing your mini with a LAN include lower life-cycle cost, a wider variety of applications to choose from, and more flexible solutions to future connectivity opportunities. The disadvantage is a slightly more complex environment for database applications and for backing up distributed data. Go for it!

■ Two advantages of replacing a minicomputer with a LAN are a lower life-cycle cost and a wide variety of applications to choose from.

Receiving an unexpected interrupt is a nasty surprise

I use *dBASE III Plus* on a Tandy 3000 that has a PC slave card and runs on a *NetWare*-compatible LAN. My terminal is a Kimtron. Almost every day I get a program lock, and the Tandy reports "unexpected SW interrupt please press (R)eboot." Is it possible that my Tandy can't handle the traffic of the LAN, or are the PC slave board and *NetWare*-compatible LAN by Alloy the problem? And what's the solution?*—Jay Stockman; East Rockaway, New York*

I ran the Alloy PC-Slave/286 under *NetWare* and didn't find the problem you described in you letter, but I did encounter it on a plain IBM PC AT. Alloy hasn't certified its drivers on the Tandy 3000, and the error message you report comes from the Tandy BIOS.

The amount of traffic isn't the problem, but small incompatibilities between the three busy software systems (Alloy driv-

■ CONNECTIVITY CLINIC

ers, Novell's *NetWare*, Tandy's BIOS) probably are. My first suggestion is to get rid of any TSR programs you have loaded on the Alloy CPU. Also call Alloy and make sure you have the latest version of its driver software—it should be Version 1.01 or later. I wouldn't be surprised if the problem happens when the printer or serial I/O ports are in use on the server. Isolate as many functions as possible to try to find the combination of functions that hangs the operating system.

Mixing operating systems on the same cable is no problem

In Connectivity Clinic, June 28, 1988, you discussed mixing operating systems on an Ethernet network. Can I simultaneously run *3+Share* and *NetWare* on a single Ethernet wire if two servers are attached? *—David Solomon (via CompuServe)*

Yes, you can simultaneously intermix *NetWare* and *3+Share* server operations on the same Ethernet cable or even on the same Token-Ring or ARCnet cabling. The packets or tokens know where they are going and how to traverse the cable regardless of the configuration of the data load they carry.

Even more interesting, if the different workstations are all running NetBIOS or NetBIOS emulation, they can use the same SNA, X.25, fax, or other gateways attached to the cable. The terminal emulators or communications drivers operate independently of the networking software and servers.

The differences among LAN software in the workstations are starting to disappear. Right now you can run the same workstation software for *3+Open*, IBM *PC Local Area Network Program*, *IBM Server Manager*, and other versions of *LAN Manager*. Version 2.15 of *NetWare* will let you run *AppleShare* workstation software in PCs or Macs in place of the *NetWare* shell. As the major companies bring to the market products that support IBM, international, or de facto standards, workstation and cabling differences will disappear quickly.

Loading *NetWare* drivers for new networking cards is easy

I enjoyed your recent review of Ethernet cards, but not many of the cards you reviewed have drivers included in the Novell *NetWare* installation menu. I would like to know how hard it is to install the drivers for new cards that aren't already in the menu Novell ships with *NetWare*.*—Bill Loftiss; Peru, Indiana*

NetWare comes with many drivers, but there are still more card manufacturers that

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On the other hand, users in your department who aren't touch typists might be better off with a function key word processor. Constantly looking at the keyboard doesn't seem to distract non-touch typists.

WordStar Does Best What Your Touch Typists Do Most

WordStar 5 is the latest release of The Touch Typist's Word Processor.



send drivers with the network adapters. In the recent Ethernet review, we tested 11 Ethernet cards, and nine of the 11 companies sent their own driver programs for *NetWare*. Each company included instructions in its documentation on how to install the drivers. But after reloading *NetWare* dozens of times, here are the shortcuts we worked out.

If you don't find the LAN driver you need in the *NetWare* menu selection, use an ASCII editor to read the LAN driver sent by the manufacturer. Look for the text string LAN_DRV_NNN (where NNN represents any number), change the NNN to 001, and save the changes. Move the changed LAN file for Version 2.1 of Novell's *NetWare* to the Auxgen and Shgen-1 diskettes. Move the object code (these are the files with .OBJ extensions) to the LAN_DRV_001 disk. This is all that's needed to display the correct LAN driver in the *NetWare* menu.

Find a fast machine to link the operating system with the LAN driver and disk driver. The machine you use for linking can be different from the machine that will finally be the server. If you install a new driver in an existing Novell operating system, always choose the Advanced System Configuration or the Install with Custom Options menu. If you chose the default options, you'll get a workout exchanging disks in the floppy disk drive, but you won't have to work through every menu option. If possible, use a computer with two floppy disk drives to create the operating system—it makes life a lot easier. The final installation of the operating system must be done on the server that's running *NetWare*.

If you are modifying an existing operating system, make a backup copy of the old Osexe-1 and Osexe-2 disks. These disks contain the final object code for the operating system. Save the old copies of the Osexe disks just in case you need the old version or there is something wrong with the new operating system.

Network Your Questions

Connectivity Clinic gives you practical solutions to networking problems of all types. We'll pay $50 or more for any tips we print, *plus an extra $25 if you submit your letter on a disk*. If you do, please include a printed copy. We'll gladly answer your questions at no charge, but we cannot answer letters personally. Mail contributions to Connectivity Clinic, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (to join, see the "By Modem" sidebar in the Productivity section). You may also contact Frank J. Derfler, Jr., via MCI Mail (use Derfler's box named CONNECTIVITY CLINIC). PC

Your Touch Typists.

Without stopping to hunt for function keys WordStar users can:
◇ lay out pages with up to 8 snaking columns
◇ create footnotes for each page or at the end of the document
◇ import Lotus 1-2-3 and dBase files without conversion
◇ customize mailings
◇ view documents as they will print including exact fonts and sizes—even view multiple pages at once.



Thousands of touch typists know and use WordStar. And thousands are more productive on WordStar than they could ever be on a general purpose function key word processor. The timelessness of the WordStar success story is as simple as that.

If there are touch typists in your department or workgroup turn to The Touch Typist's Word Processor. Turn on the power of WordStar.

For more information about how WordStar can help you get the most out of your workgroup's touch typists see your dealer or call **1-800-227-5609**, ext. 615.

WORDSTAR.5

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NEC introduces the best VGA monitor you can buy. MultiSync® 2A.

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MultiSync 2A. One super VGA monitor.

VGA mode shown at 320 x 200

C&C
Computers and Communications

that's also a SuperVGA monitor.



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And since you're most likely buying a board that goes beyond VGA, your monitor should too. For literature call 1-800-826-2255. For technical details call NEC Home Electronics (USA) Inc. at 1-800-FONE-NEC.

MultiSync is a registered trademark of NEC Home Electronics (USA) Inc.

MultiSync 2A. One SuperVGA monitor.

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CIRCLE 153 ON READER SERVICE CARD

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CompuAdd Starter Kits provide a great way to get into personal computing immediately. We've bundled computer and keyboard, hard drive, monitor, printer, software and all the accessories and supplies you need to get started, and packaged them in a specially priced kit. And we've created an assortment of Starter Kits to meet the price and performance needs of a variety of users.



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 CompuAdd 386/16
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 - Dual floppy/hard drive controller
 - Five 16-bit and two 8-bit expansion slots
 - 80287 math coprocessor support
 - Choice of AT-style, 5151, or enhanced 101-key keyboard
- **Monitor**
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- **Hard Drive**
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- **Printer**
 Epson® LX-800
 - 180cps draft, 30cps near letter quality
 - Multiple type styles
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- **Software**
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- **Accessories**
 - 200 sheets of continuous form paper
 - Printer cable and ten blank floppies

$2695

Hard Drives	MGA	EGA	VGA
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71MB	$2865	$3265	$3415

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 - Eight expansion slots
 - Math coprocessor support
 - Choice of AT-style, 5151, or enhanced 101-key keyboard
- **Monitor**
 Monochrome monographics video package, or enhance your system with EGA or VGA video.
- **Hard Drive**
 20MB fully installed or upgrade to a higher capacity drive.
- **Printer**
 Epson LX-800
 - 180cps draft, 30cps near letter quality
 - Multiple type styles
 - Tractor/friction paper feed
- **Software**
 - CompuAdd INTEGRATOR Program/file managers, cardfile database, calendar, calculator, text editor, and PC-FullBak
 - CompuAdd MS-DOS and GW BASIC
- **Accessories**
 - 200 sheets of continuous form paper
 - Printer cable and ten blank floppies

$1595

Hard Drives	MGA	EGA	VGA
20MB	$1595	$1945	$2145
40MB	$1715	$2065	$2265

Career Starter Kit™

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 - 8088 processor providing 10MHz and 4.77MHz switchable system speeds
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 - Floppy drive controller
 - Eight expansion slots
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 - Choice of AT-style, 5151, or enhanced 101-key keyboard
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- **Hard Drive**
 Optional hard drive.
- **Printer**
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 - CompuAdd MS-DOS and GW BASIC
- **Accessories**
 - 200 sheets of continuous form paper
 - Printer cable and ten blank floppies

$929

Hard Drives	MGA	EGA	VGA
No Hard Drive	$929	$1279	$1479
20MB	$1179	$1529	$1729

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- 80287 math coprocessor support
- Choice of enhanced 101-key, AT-style, or 5151 keyboard
- 17.6 on Norton's SI Benchmark 4.0 test

$1895

386/16 System	MGA	EGA	VGA
40MB, 28ms	$2,449	$2,799	$2,999
80MB, 28ms	$2,695	$3,045	$3,245

CompuAdd 286/12

- 80286-12 processor running at 12MHz or 6MHz, switchable system speeds
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- 512KB RAM expandable to 1MB
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- 80287 math coprocessor support
- Choice of enhanced 101-key, AT-style, or 5151 keyboard
- 13.7 on Norton's SI Benchmark 4.0 test

$995

286/12 System	MGA	EGA	VGA
20MB, 65ms	$1,399	$1,899	$1,899
40MB, 40ms	$1,579	$1,879	$2,079

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- Dual floppy/hard drive controller
- Six 16-bit and two 8-bit expansion slots
- 80287 math coprocessor support
- Choice of enhanced 101-key, AT-style, or 5151 keyboard
- 9.4 on Norton's SI Benchmark 4.0 test

$895

286/10 System	MGA	EGA	VGA
20MB, 65ms	$1,249	$1,599	$1,799
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- Math coprocessor support
- Front panel display with keylock, reset button, turbo button, plus LED indicators
- Choice of enhanced 101-key, AT-style, or 5151 keyboard

$595

Turbo/10 System	MGA	EGA	VGA
No Hard Drive	$729	$1,079	$2,999
20MB, 65ms	$999	$1,349	$1,549

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CGA

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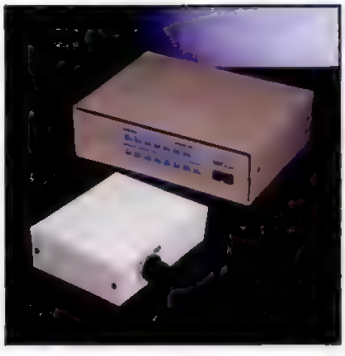
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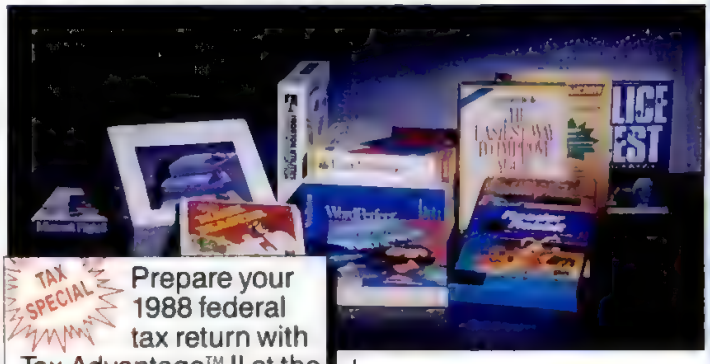
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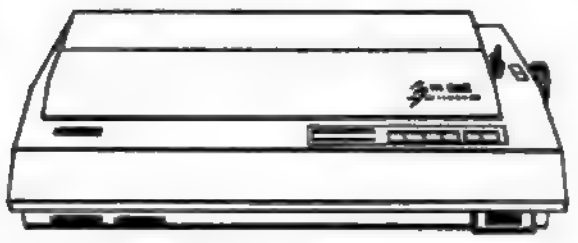
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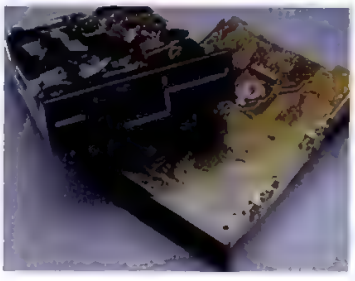
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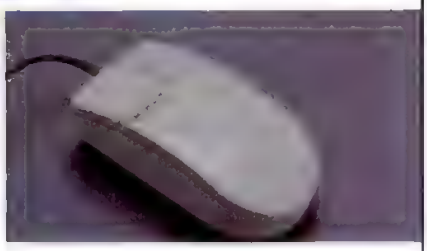
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FX 1050	$429	LQ 950	$579
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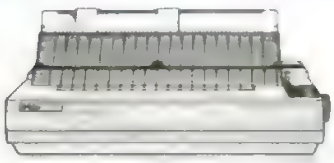
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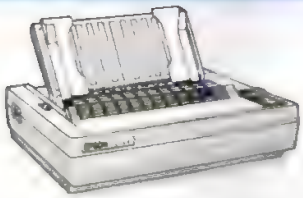
Epson FX-850

- Narrow-carriage 9-pin, dot-matrix printer
- SmartPark,™ a unique Epson paper-handling innovation, lets you switch from fanfold to single sheets or envelopes without removing hardware or paper
- With a standard push feed tractor and single sheet friction feed, the FX-850 can handle virtually any type of paper as well as envelopes
- Exclusive SelecType front control panel puts popular printer features and SmartPark operations at your fingertips
- The FX-850 prints 264 characters per second (CPS) in high-speed draft mode (12 CPI); 54 CPS in Near Letter Quality mode (12 CPI).



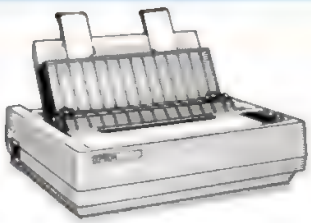
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- Wide-carriage 9-pin, dot-matrix printer
- SmartPark,™ a unique Epson paper-handling innovation, lets you switch from fanfold to single sheets or envelopes without removing hardware or paper
- With a standard push feed tractor and single sheet friction feed, the FX-1050 can handle virtually any type of paper as well as envelopes.
- Exclusive SelecType front control panel puts popular printer features and SmartPark operations at your fingertips
- The FX-1050 prints 264 characters per second (CPS) in high-speed draft mode (12 CPI), 54 CPS in Near Letter Quality mode (12 CPI)



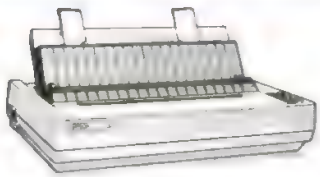
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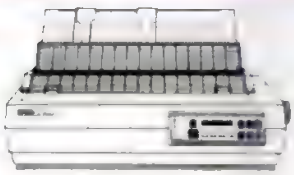
Epson LQ-850

- Epson's 24-pin, dot-matrix technology creates true letter quality characters
- Epson's SmartPark™
- Exclusive SelecType front control panel offers quick, easy selection of popular typestyles, fonts and pitch
- 264 Characters per second in the high-speed draft mode delivers outstanding productivity
- 88 Characters per second in Letter Quality mode for enhanced, high-resolution characters
- In draft mode or Letter Quality mode, the LQ-850 runs at a surprisingly quiet 55 dB noise level



Epson LQ-1050

- Epson's 24-pin, dot-matrix technology creates true letter quality characters
- Epson's SmartPark™
- 264 Characters per second in the high-speed draft mode delivers outstanding productivity
- 88 Characters per second in Letter Quality mode for enhanced, high-resolution characters
- In draft mode or letter quality mode, the LQ-1050 runs at a surprisingly quiet 55 dB noise level
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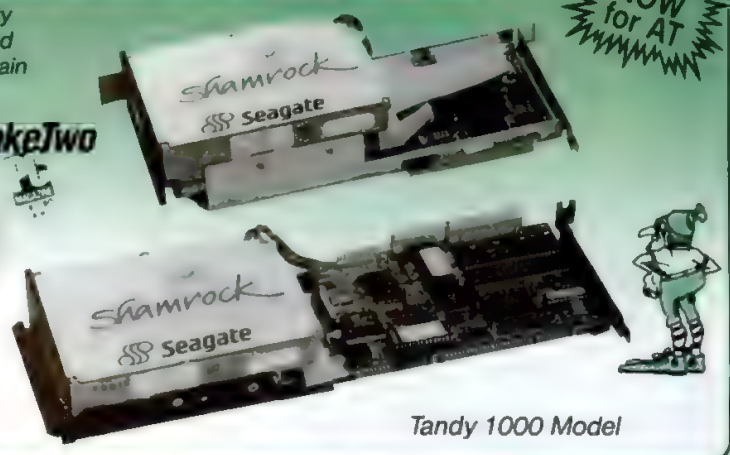
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KX-P1124

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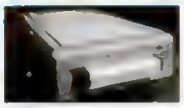
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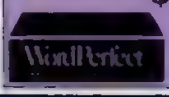
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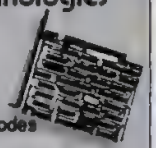
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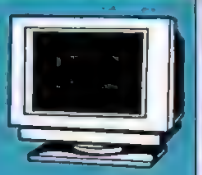


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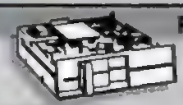
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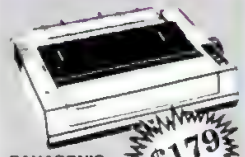
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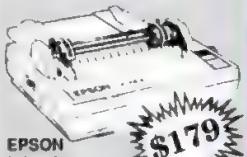
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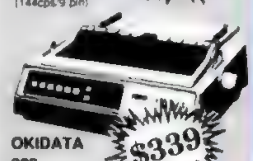
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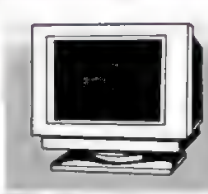
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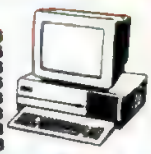
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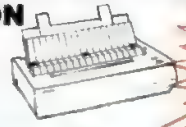
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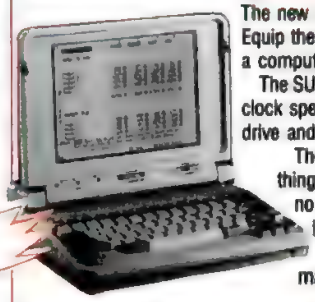
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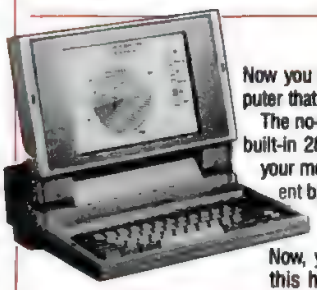
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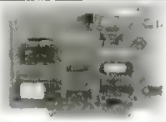
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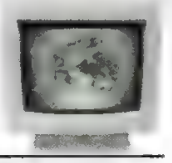
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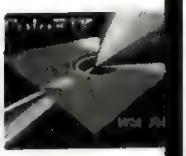
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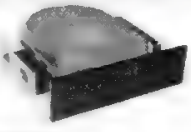
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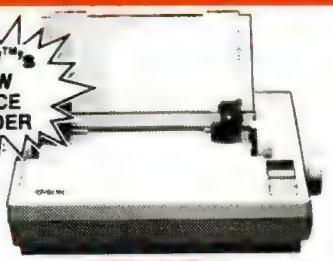
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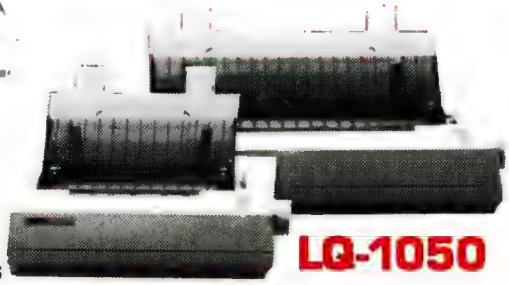
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LQ-1050

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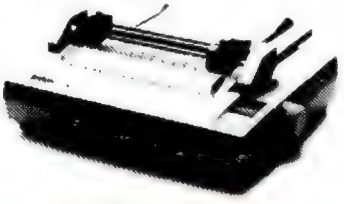
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Options
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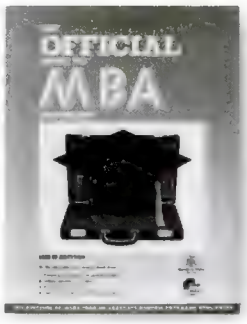
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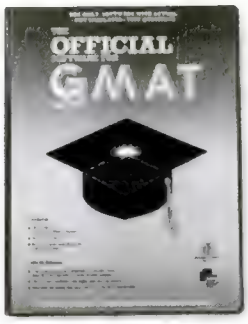
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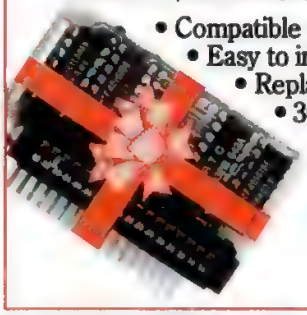
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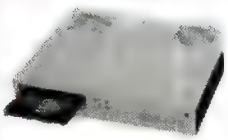
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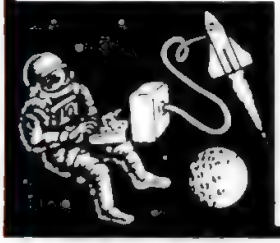
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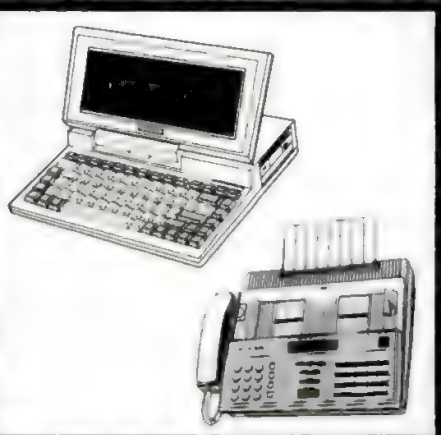
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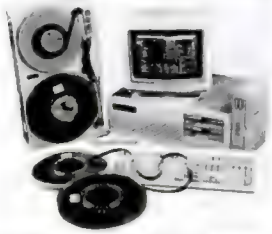
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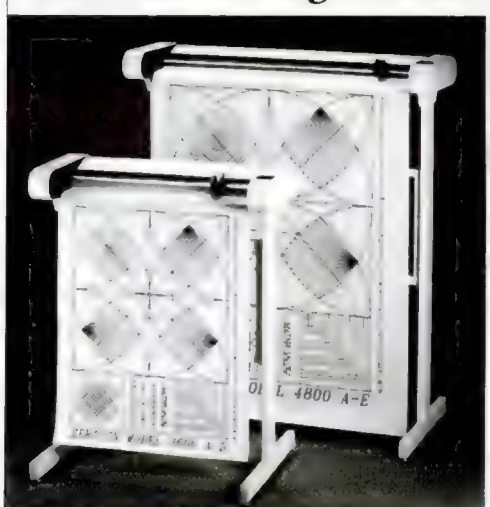
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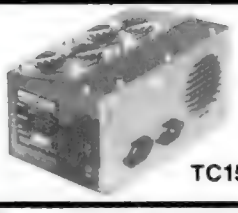
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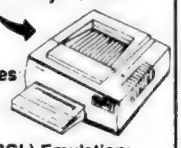
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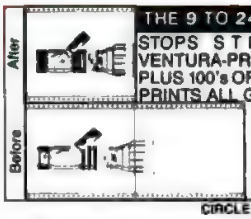
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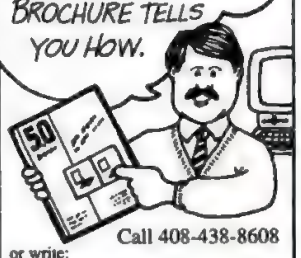
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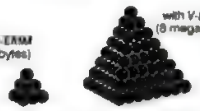
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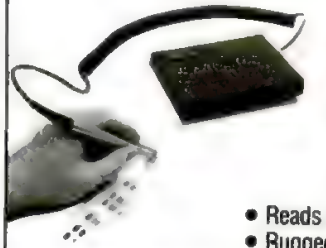
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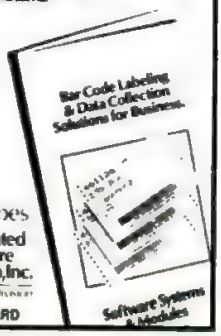
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- j. ☐ No

4. For how many IBM PCs and compatibles do you specify brands of products?
- k. ☐ 10 or less
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- m. ☐ 26–100
- n. ☐ 100 or more

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- t. ☐ Now
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PC 4/11-4

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COMING UP

DATA TRANSFER SPECIAL Find your way through the complicated world of data transfer and media conversion using a special multipart cover story as your guide.

■ **The 3½-inch Conversion** Getting your data from AT-class machines equipped with 5¼-inch drives to laptops or PS/2s equipped with 3½-inch drives is a bothersome chore. It can be made easy either by installing a 3½-inch drive in your AT or by using file transfer software and cable to send the information across. PC Labs investigates the options and takes you through the installation process.

■ **Format Conversion Software** It's a simple task to move your text files from one word processor to another, but it isn't so easy to reenter all your tab settings, underlining, and margins after they've been lost in the shuffle. Solve the problem with format conversion software that guarantees a smooth translation for your text files.

■ **From PC to Mac** Because the Macintosh and PC environments both offer a wealth of indispensable programs, communication between the two is essential. Read a detailed overview of the dozens of products that have been designed to facilitate this integration.

■ **From PC to Mainframe** Why not discover the new ease of half-inch nine-track magnetic tape as a means of transporting data between PCs and mainframes? It's an idea whose time has come. . . again.

VIRUSES The virus threat is real, but you can protect yourself with one of several affordable antivirus programs, ranging in price from $10 to $189. *PC Magazine* reviews 11 protection packages, gives you the facts on the virus syndrome, and explains how simple common sense may be the best protection you'll ever have.

DISKLESS LANSTATIONS By adding diskless LANstations to your network, you gain smaller footprints, quieter operation, and security. Frank J. Derfler, Jr., evaluates models from ALR, Corman Technologies, Dell, Earth Computer Technologies, NCR, Network Innovations, Racore, 3Com, and Unisys. PC

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AFTER HOURS



In this room, Bubble Ghost has to show musical talent in order to clear a path for the bubble

GAMES

Bubble Ghost: A Haunting Game of Skill And Finesse

BY ILONA PRICE

If you think computer animation games can be challenging, amusing, and engrossing, Accolade won't burst your bubble. In fact, if you break all of the bubbles in Accolade's *Bubble Ghost*, you lose.

This $34.95 game of finesse and perspective, for one or two players, is set in the late inventor Heinrich Von Schtinker's 35-room haunted castle. The object of the game is to manipulate Heinrich's spirit (a.k.a. Bubble Ghost) so that the ghost blows a bubble through the 35 rooms of the castle, past all of Von Schtinker's mad inventions, most of which are fatal to bubbles. The graphics are exceptional, and each room of the castle is full of imaginative detail and brilliant colors.

Like all bubbles, the one in this game is delicate. If it hits one of the many obstacles, it bursts and you lose one of your six allotted bubbles. The bubble goes nowhere until you figure out how to get by these objects. Solving one of these puzzles earns you 5,000 points. The answer is usually simple, but not always obvious. In one room, a fan blows the bubble back toward the hapless ghost, no matter how hard he puffs. The solution is to shut off the fan, but how? Questions like this are the heart of the game, and set *Bubble Ghost* apart from other arcade-style games.

Each time you complete a level your ghost earns an extra bubble. Once you pass through all of the rooms in the castle, the ghost is set free and the castle is no longer haunted.

The Bubble Ghost himself is indestructible. He can touch or bump into any obstacle without injury. If you make the poor spirit blow too hard, however, he turns red and you lose 1,000 points.

Bubble Ghost requires skill, patience, and careful planning. A practice mode lets you practice any level of the game, which is useful when a particular level is giving you difficulty. It is not difficult to grasp the object of the game, but you must put thought into your escape from the castle and be very careful not to "blow it" by bursting all of the bubbles.

List Price: *Bubble Ghost*, $34.95. **Requires:** 256K RAM, DOS 2.1 or later, CGA graphics. Not copy protected. Accolade Inc., 550 S. Winchester Blvd., #200, San Jose, CA 95128; (408) 296-8400.

CIRCLE **415** ON READER SERVICE CARD

GAMES

PC Meets Game Board As Star Saga: One Mixes Old and New

BY DONALD B. TRIVETTE

During a space plague in the year 2490, the Earth and eight nearby planets banded together in a confederation named Nine Worlds. To keep alien diseases from ever again devastating its inhabitants, the confederation built an impenetrable wall called "The Boundary" to separate Nine Worlds from the rest of the cosmos.

That's the opening premise of *Star Saga: One*, a multimedia game for one to six players that involves not only your PC but also a game board and tokens. You and your fellow gamesters select your characters from a cast that includes Laran Darkwatch, a mystic; M. J. Turner, a hotshot pilot; and Lee Dambroke, a university xenobiologist.

Star Saga is not a conventional computer game with colorful maps, snazzy sound, and wild animation. Nor is it the usual *Adventure*-like text game. Instead, *Star Saga* is a hybrid role-playing board game that uses the computer to direct the play as a human moderator might. At each turn, you go to the computer and tell it who you are, and then you tell it how you played your turn. The Computer Game Master—a.k.a. the Chubby Grey Monitor—tells you the results of your move and directs you to read passages from the *Star Saga* text.

Reading is what this game is really about, and the *Star Saga* text covers hundreds of pages. Although you need read only those passages that apply to your character, even that can involve a considerable amount of text. You must also read the 12-page booklet that introduces the game, sets the rules, and describes your character. As the game progresses, players compete against one another for position, resources, and knowledge, but in the end everyone must cooperate to banish a common foe.

Star Saga: One is not something you pick up to kill a few hours before a movie. Indeed, the manual advises that just one game may take 60 hours. Fortunately, it doesn't have to be completed in a single sitting.

List Price: *Star Saga: One*, $79.95. **Requires:** 256K RAM, DOS 2.0 or later. Not copy protected. Masterplay Publishing Corp., 8417 Sun State St., Tampa, FL 33634; (813) 888-7773.

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Up to six people may play Star Saga: One, *each choosing a unique role.*

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AFTER HOURS

PERSONAL FINANCE

Andrew Tobias' Checkwrite Plus: A Detailed Approach to Bill Paying

BY GUS VENDITTO

Is a PC a good tool for managing your checkbook? Only if it makes the work go faster. That means getting the checks out the door more easily and spending less time sweating over a complicated balance sheet.

Andrew Tobias and the other folks who brought you *Andrew Tobias' Managing Your Money* have decided to take a crack at this seemingly simple job. They know a lot about personal finance, but they sure don't know how to make checkbook management simple.

I'd heard a lot about *Quicken* and had been meaning to give it a try. *Quicken* has been spectacularly successful because it prints checks easily and keeps simple records that you can customize into splendid sophistication. The way I heard it, Andrew Tobias was going to go *Quicken* one better, with a program that's easier to use and that provides more value in the long run by putting some order into household budgeting.

So I tried both, starting with *Checkwrite Plus*. After 20 minutes of fumbling in and out of Budget Categories, Money Accounts, and Loan Records—without succeeding in getting my checking account set up—I ran, nearly screaming for mercy, to *Quicken*. In less than 5 minutes, I was busily printing checks.

I dutifully returned to *Checkwrite Plus* for the purposes of this review. The interface is inherited from *Managing Your Money* and the structure is designed to organize your cash flow. It encourages you to have discipline, requiring that you pay attention to assigning payments to categories.

The manual guides you through the intricacies of predicting loan payments before it gets to the task at hand, printing checks.

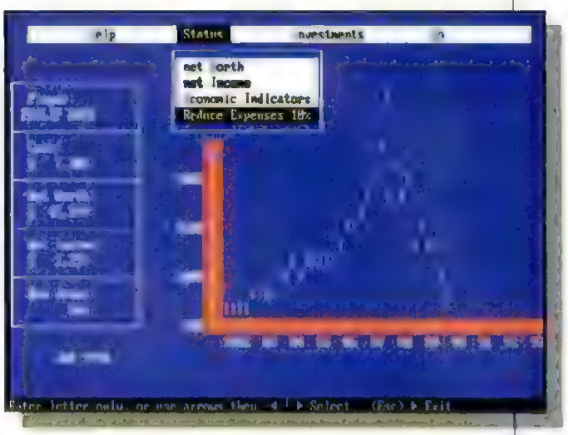
If you want a program that will automate your bill paying, remember long account numbers, print checks in a flash, and save records, get *Quicken*. If you want to analyze your cash situation, set aside a few hours to pore over *Andrew Tobias' Checkwrite Plus*.

List Price: *Andrew Tobias' Checkwrite Plus*, $69.95.
Requires: 256K RAM, DOS 2.0 or later. Not copy protected. MECA Ventures Inc., 355 Riverside Ave., Westport, CT 06880; (800) 835-2246.

CIRCLE **413** ON READER SERVICE CARD



You fill in the blanks to pay your bills with Andrew Tobias' Checkwrite Plus *and then assign the payments to categories for detailed budgeting. Unfortunately, it's not as easy as it sounds.*



Wealth Insurance tracks your hypothetical fortunes in each of the available scenarios. When income is down, expenses must be cut.

PERSONAL FINANCE

The 1990s Economy: Wealth Insurance Looks Ahead

BY PHILLIP F. H. ROSE

It's the spring of '92, now 3 years into the Great Depression of the 1990s. Few saw it coming; even Black Monday in '87 didn't shake people up. Today the Dow is sitting at around 200, with unemployment at about 25 percent. But you are sitting pretty. You shorted stocks on the way down and have an extra $20,000 sitting in T-bills. You still have your job, and you are just waiting for the stock market to heat up.

This is one scenario that you can play through in *Wealth Insurance*, a new financial simulation program based on the predictions of Paul Erdman, author of *The Crash of '89*. You take your finances through one of two scenarios for the '90s: depression or recession. Or you can see how well you would have done in the '30s depression, the '61 recession, or the '80s "boom" years.

Several good sources, including Erdman's own book *What's Next?*, offer solid advice on how to prepare for the bad economic times ahead. But nothing hits home quite as effectively as facing the news, in this game, that your income has been cut by four-fifths and your mortgage must still be paid.

The game's main shortcoming is that it misses a golden opportunity to use the computer's power. You should be able to translate your current financial state into 1929 dollars and replay the Great Depression. Or plug in your actual numbers for 1981 and relive the 1980s with hindsight. Instead, the game forces you, when playing the historical scenarios, to assume a randomly assigned portfolio.

Other shortcomings arise from limits on your control over the game. Even if you make a simple typo and buy a Texas condo rather than New York land, you are stuck with it. You also cannot edit your personal financial statistics after leaving the first screen.

Rough economic times may be ahead. Of course, *Wealth Insurance* supports Erdman's predictions, but anyone can gain by playing the game and experimenting with strategies.

List Price: *Wealth Insurance*, $39.95. **Requires:** 512K RAM, CGA or EGA video card, DOS 2.0 or later. Not copy protected. Britannica Software, Blue Chip Software Series, 345 4th St., San Francisco, CA 94107; (800) 572-2272.

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AFTER HOURS

PERSONAL FINANCE

Andrew Tobias Shows You How to Manage a Modest or Major Fortune

BY CHRISTOPHER BARR

Andrew Tobias' Managing Your Money is the menu-driven alternative to having a personal financial adviser, private secretary, and bookkeeper. It's not a difficult program to master, but, like your parents used to tell you about any complex project, you only get out of it what you put into it.

Created by Andrew Tobias, the author of a number of best-selling books on personal investing, *Managing Your Money* is a complete system that lets you keep control of your income and outgo. Since it's not written in a double-entry, accounting-only style, this software can be appreciated by young people with only a checking account, as well as by more-sophisticated investors with complicated portfolios.

Although the multiplicity of menus may drive a power user crazy, the program has a consistent, easy-to-learn user interface. There is context-sensitive help throughout the software, which is organized as a series of "chapters."

Managing Your Money operates as a series of connected databases that track all the assets and liabilities that make up your financial body. The core of the program tracks two main areas of your finances—your budget (including your checkbook) and your investment portfolio. The rest of the program helps with topics like estimating your federal income taxes, determining how much insurance you should carry, and setting up your kid's college fund.

In the Budget and Checkbook chapter, you track all of your money accounts. This includes checking, savings, and charge-card accounts. The number of accounts you can set up is limited only by storage.

Setting up accounts is not difficult, but it is time-consuming. Fortunately, both the manual and the on-line help are written with an ease and humor that make the tedium of the setup easier to bear. After you've finished this task, it shouldn't take more than an hour or two a week to keep your record current. Once an account has been entered—a checking account, for instance—you can work with the account and spend or receive money.

Spending consists of writing checks (or any other kind of disbursement), while deposits are recorded as money received. When you record a check, you can allocate the amount to a predetermined budget category and thus track your spending. You can purchase preprinted checks and have *Managing Your Money* actually print them.

The Budget and Checkbook chapter has some other useful functions. You can forecast cash flow and track loans, for instance. If you have a small business, you can call up an accounts-payable module, and a receivables module, too.

The other major section of *Managing Your Money* is the Portfolio Manager. This is where you keep track of the bulls and bears, stamps and coins, and other equity instruments you own. It doesn't matter if you have one investment or 100; *Managing Your Money* can track them all. You can establish taxable, nontaxable, cash-management, and hypothetical portfolios. Unfortunately, dividends and interest aren't calculated and added automatically. You'll have to do that yourself.



Each portfolio can handle a number of individual transactions. Andrew Tobias' Managing Your Money includes the value of all assets when it calculates your net worth.

Not the least important of *Managing Your Money*'s tools is the Financial Calculator. Among other things, it will analyze your retirement package, tell you if you should refinance your mortgage, or scare you to death with the cost of junior's Harvard education.



After you establish the budget categories, Andrew Tobias' Managing Your Money exports the taxable projections to be used in the Tax Estimator chapter.

The most fun you'll have is when you get to chapter 8, which calculates your net worth. *Managing Your Money* considers all of the proper asset and liability accounts, recognizes which accounts to include and which to ignore, and calculates your worth.

Managing Your Money comes on five 360K disks and requires only 256K RAM and a single disk drive, but you will want a hard disk and a minimum of 512K for maximum productivity. *Managing Your Money* uses 1.5MB of disk space *before* you enter your first record. Version 5.0, updated to reflect the tax code that's applicable for the tax year of 1988, does not use either expanded or extended memory.

Andrew Tobias' Managing Your Money is the complete financial management tool it claims to be. It won't tell you which stocks to buy or sell, when to refinance your mortgage, or when to invest in Japanese yen futures. But good, sound fiscal advice is available to you on practically every screen.

List Price: *Andrew Tobias' Managing Your Money*, Version 5.0, $219.98. **Requires:** 256K RAM, DOS 2.0 or later. Not copy protected. MECA Ventures Inc., 355 Riverside Ave., Westport, CT 06880; (800) 835-2246.

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PERSONAL FINANCE

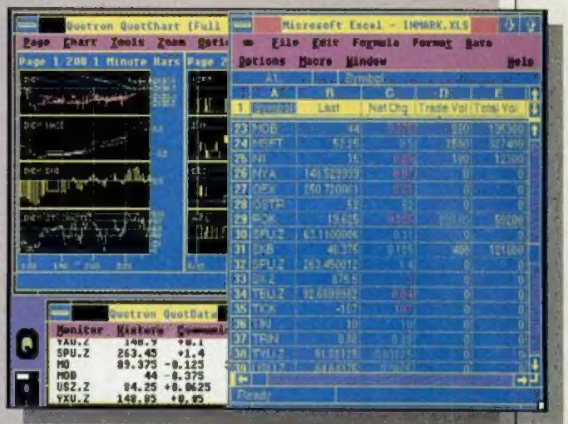
Small Investors Hit the Big Time with Quotron Open Windows

BY TONY RIZZO

What major advantage do professional stockbrokers have over the lowly "small investor"? The smug answer would have to be "insider trading." But in all seriousness, access to information is the key to modern-day investment analysis and strategy.

Where do the pros get this valuable information? The ubiquitous Quotron terminal is the primary professional trading tool to have emerged over the last decade or so. This weapon puts a wide assortment of financial data right at the professional investor's fingertips.

What can the serious small investor do to compete with the big boys, especially when the heavyweights have easy access to all this critical information? Simple—join the club. With *Quotron Open Windows*, a *Microsoft Windows*–based collection of applications designed by Inmark in conjunction with Quotron Systems, the little guy can do just that.



QuotData *supplies information to programs such as* Microsoft Excel *(right side of screen) and to* QuotChart.

QuotTerm

Quotron Open Windows consists of three specific applications, the first of which, *QuotTerm*, provides complete emulation of the professional's Quotron terminal. *QuotTerm* supports all standard terminal features but, because it is *Windows* based, it offers substantial visual enhancements over the standard, character-based terminal. All of the usual *Windows* features are available. For instance, you can resize the *QuotTerm* window and point and click with the mouse to obtain quotes or news stories. Blink rates and colors can be user defined to customize the display of information about securities.

QuotData

Along with *QuotTerm* comes *QuotData*, an application that functions as a database and server for financial data. Every sort of historical financial fact is available on-line from Quotron via the underlying Quotron network. Even more important, *QuotData* collects real-time, tick-by-tick data on securities, futures, and other instruments, in the process of building a user-defined database of absolutely current information. It also distributes the information.

QuotData acts as a server for other *Windows* programs (*Microsoft Excel*, for example), with which it communicates through *Windows'* Dynamic Data Exchange (DDE) protocol. The database information becomes available to other applications either in real time, as *QuotData* actively collects data, or through stored historical information.

QuotChart

QuotChart rounds out the trio of applications that make up *Quotron Open Windows*. As its name suggests, *QuotChart* is an advanced and very sophisticated charting and analysis tool. Its features go well beyond those of any other charting package that I've seen.

Charting historical data is simple. You define the data and the desired time frame, and then apply your analysis. Just about everything can be done by pointing and clicking with the mouse. As many as eight charts at a time instantly come to life, displaying trendlines, moving averages, Gann angles, and much, much more. And best of all, it's all in real time.

Such sophistication does not come without a price. After all, this is the very same software professional traders use. Quotron charges monthly fees for the use of the applications, and there is a one-time, $500 installation charge. In addition, you will need fairly heavy-duty PC hardware, probably including at least 2MB of RAM, to use these packages.

Is it necessary to install *Quotron Open Windows* to manage your first employee stock options purchase? Of course not. But if you are a serious investor with a great deal of time on your hands and money invested in your portfolio, membership in the big boys' fraternity is now open to you.

List Price: *Quotron Open Windows* installation fee, $500. **Requires:** 80286- or 80386-based PC, *Microsoft Windows*. **List Price:** *QuotChart*, $300 monthly fee, *QuotData*, $250 monthly fee, *QuotTerm*, $100 monthly fee. **Requires:** 2MB RAM (640K RAM for *QuotTerm*), hard disk, serial port, EGA or VGA graphics, mouse, DOS 3.2 or later. Not copy protected. Quotron Systems Inc., 12731 W. Jefferson Blvd., Los Angeles, CA 90066; (213) 302-4621.

CIRCLE **411** ON READER SERVICE CARD

AFTER HOURS INDEX

Andrew Tobias' Managing Your Money
Software that minds your budget and tracks your investments.
Andrew Tobias' Checkwrite Plus
A complicated solution to a simple task: managing your checking account.
Wealth Insurance
How to hold on to what you've got in the uncertain future.
Bubble Ghost
An imaginative, arcade-style game for boys and ghouls of all ages.
Star Saga: One
A hybrid game that combines the PC with a traditional board game.

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DO YOU ARE YOUNG AND ENERGETIC, WITH A GOOD SENSE OF HUMOUR AND A LOVE OF COMPUTERS? THEN WHAT ARE YOU WAITING FOR? WE'RE LOOKING FOR YOU!


"The cost was £1,500 [including] display-work painting, and evidence of the hurry"
1851